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NEC's ProSpeedCSX Does It First

- How They Did It
- How Many Compromises
- Who'll Be Next

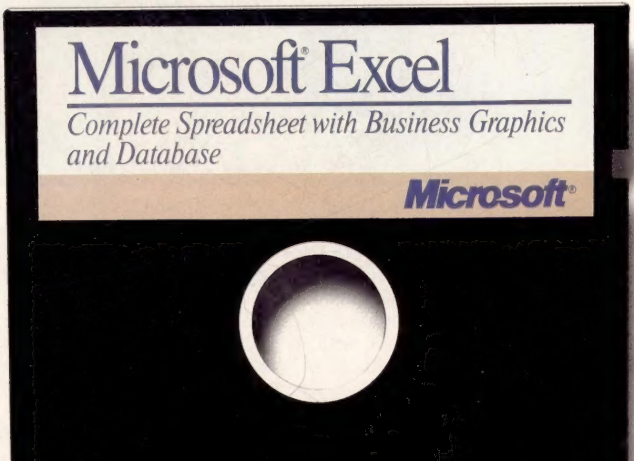


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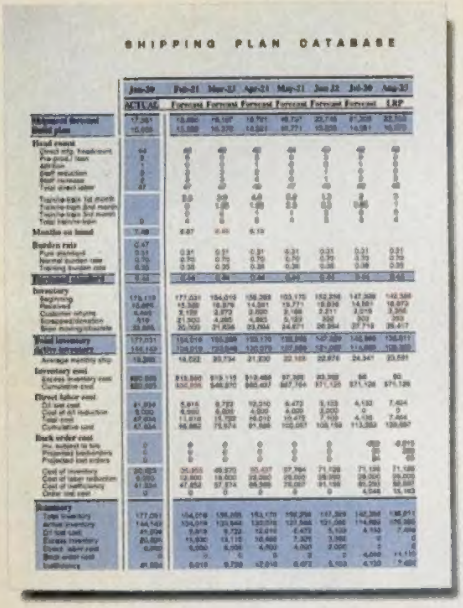
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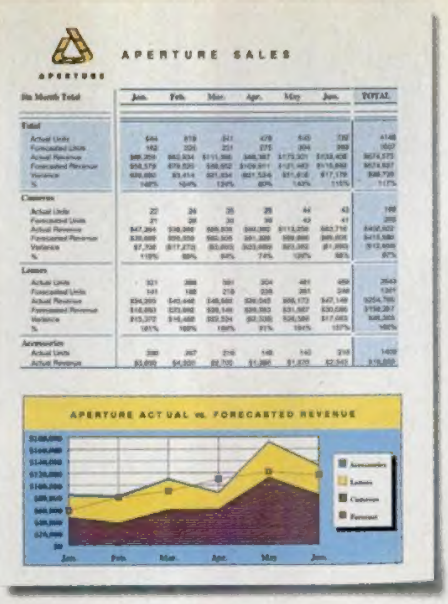
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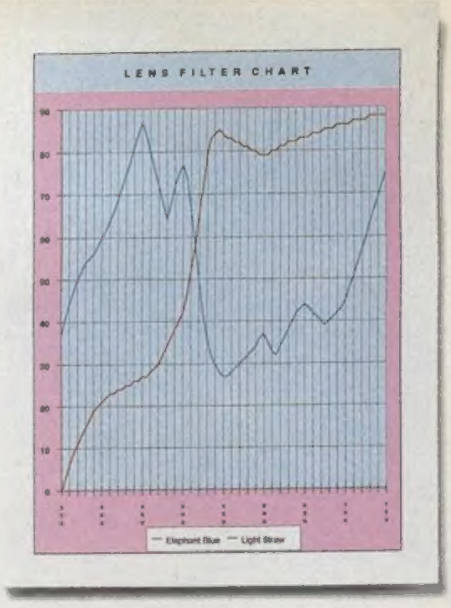
When 1-2-3 users finally make the decision, they'll be amazed at what happens.



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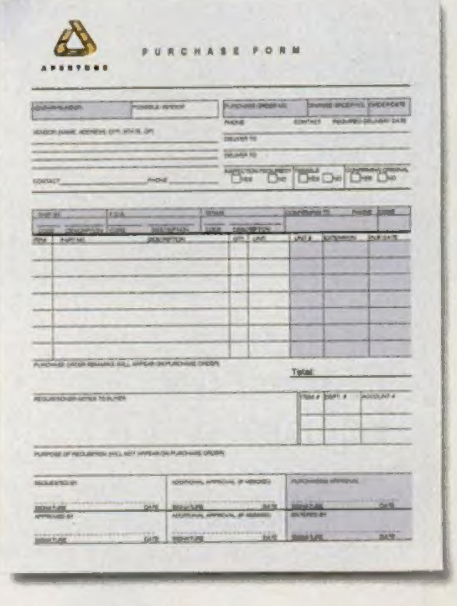


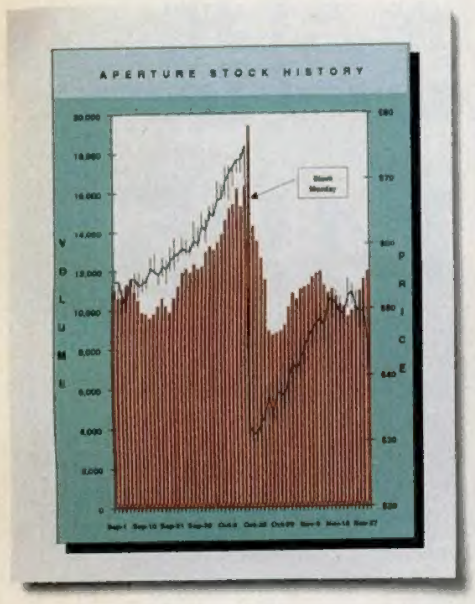


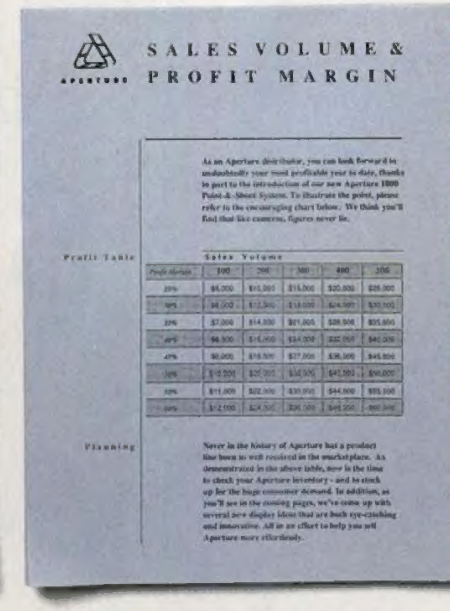


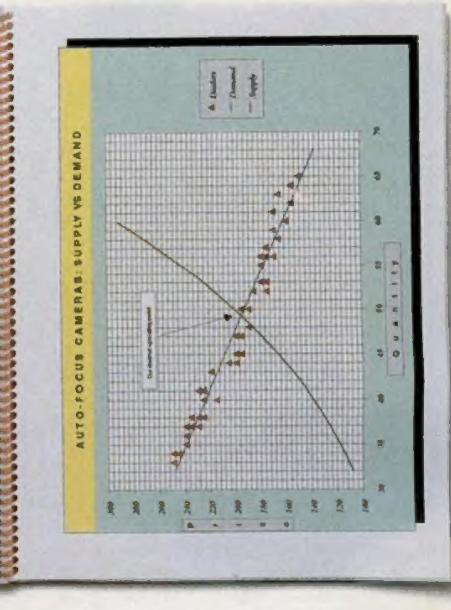






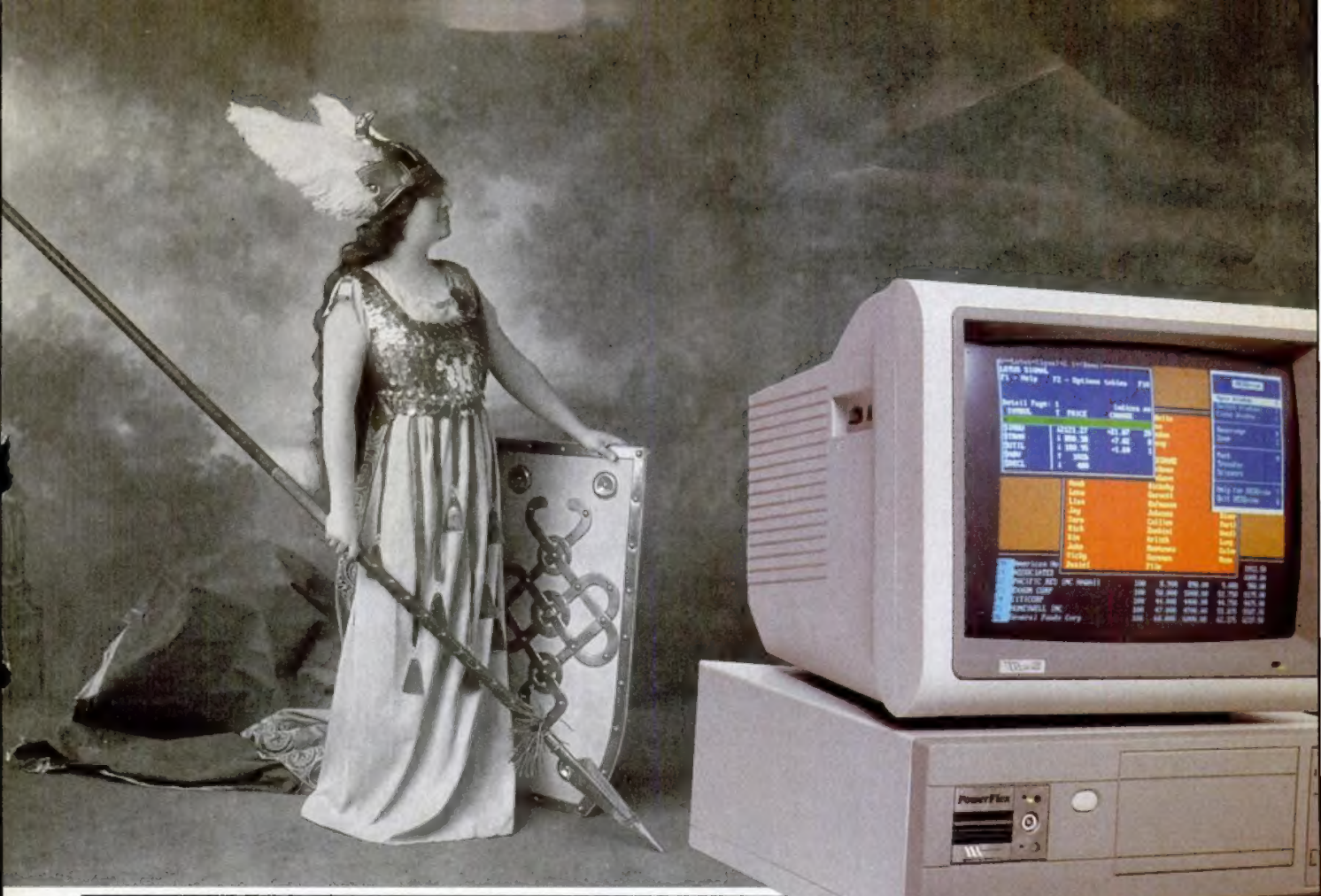




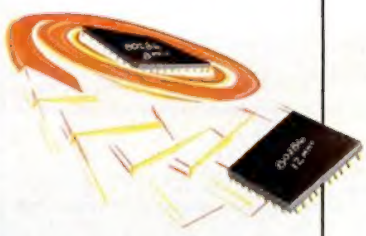


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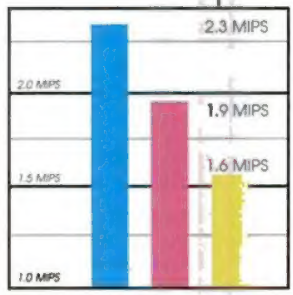
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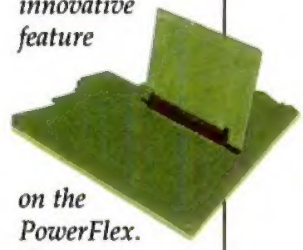
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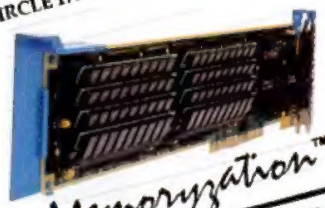
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Inside

PC Magazine's primary mission has always been to help our readers work faster, better, and smarter. In large part, this means reviewing the products that promise to speed or simplify your tasks. But another key part of the way we fulfill our mission is the information we provide in the Productivity pages.

While many readers may have come to know the Productivity section as the province of techies only, a change is taking place under the direction of senior editor Tony Rizzo. Although programming sections like Languages will remain unaltered, you can expect to find—particularly in Lab Notes—an exploration of the ways end users can get the most out of the software they already own.



King of the macros: Contributing editor Neil Rubenking gets the jump on oft-repeated *WordPerfect* procedures.

For example, in the current issue's Lab Notes ("WordPerfect Offers a Bona Fide Programming Environment"), the focus is on one of the most popular word processors around. *WordPerfect* appears often enough on *PC Magazine*'s Top Ten Sellers list to verify that people are buying it in quantity. What is perhaps less quantifiable is the number of people who are programming in *WordPerfect*—less quantifiable because many don't even know they're doing it.

Contributing editor and Lab Notes author Neil Rubenking helps lead these closet programmers out into the open. "If you're using *WordPerfect* 5.0's advanced macro features, you are programming," Rubenking comments.

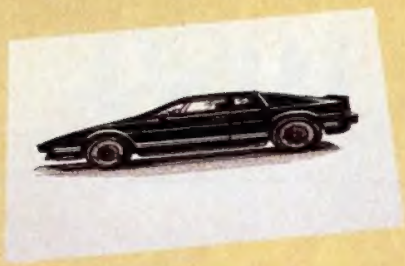
There's an important reason for attaching the proper name tag to your actions. "To do grand things with macros, you really have to think of it as programming," Rubenking notes, "and there are standard programming techniques you can follow to make your tasks easier." With some help from these Lab Notes, you will be able to master the variables, loops, and other programming facilities that form *WordPerfect*'s macro programming language.

Rubenking has been a *WordPerfect* aficionado since 1983—that's when a PC first made its way into the San Francisco Zen center where he was employed. Not only did Rubenking soon become the resident *WordPerfect* whiz, but he also began staying late at the office to learn programming with *Turbo Pascal*. That he enjoyed working with PCs came as a surprise, as his previous computer experience had been "a repulsive one, involving FORTRAN and punch cards."

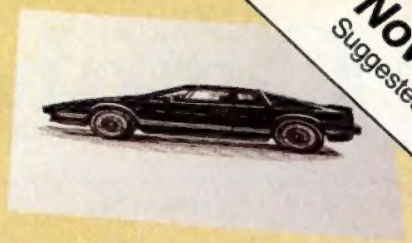
In addition to being a *WordPerfect* maven, Rubenking is one of the most prolific of the various *PC Magazine* editors who log on to PC MagNet to field questions and comments from users. According to Rubenking, the best part about MagNet is that its interactive nature lets him "offer information to help users while learning a lot from them, too." That, after all, is the name of the game.—**Jennifer Zaino** ■

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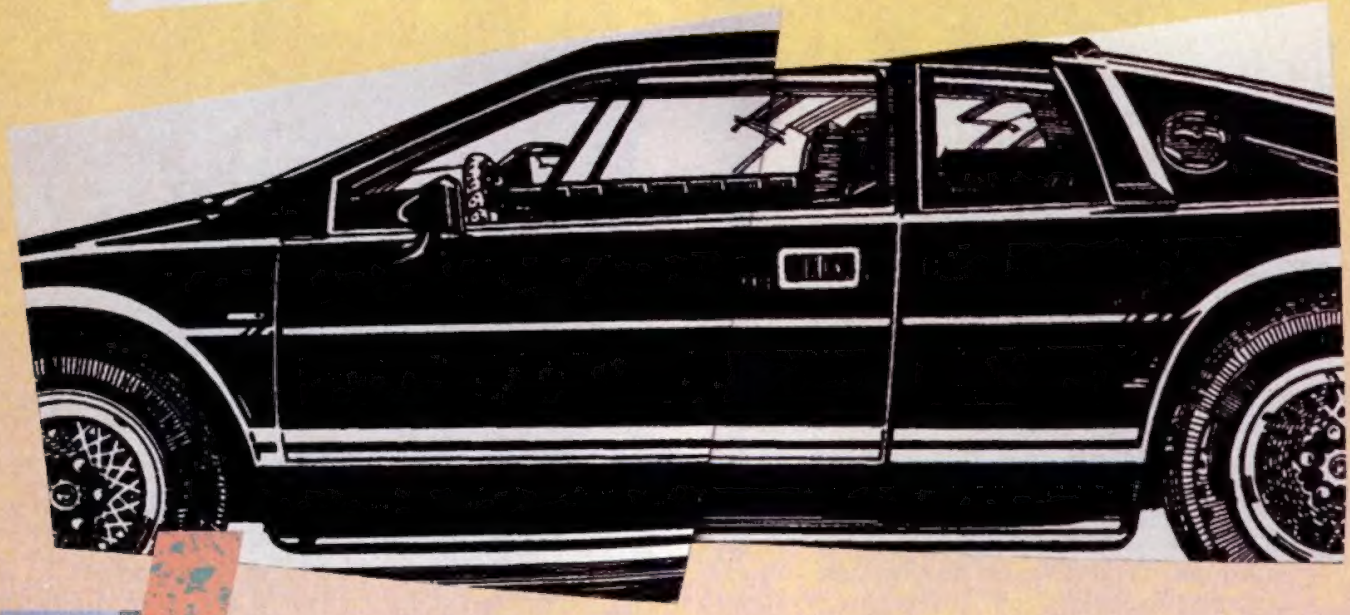
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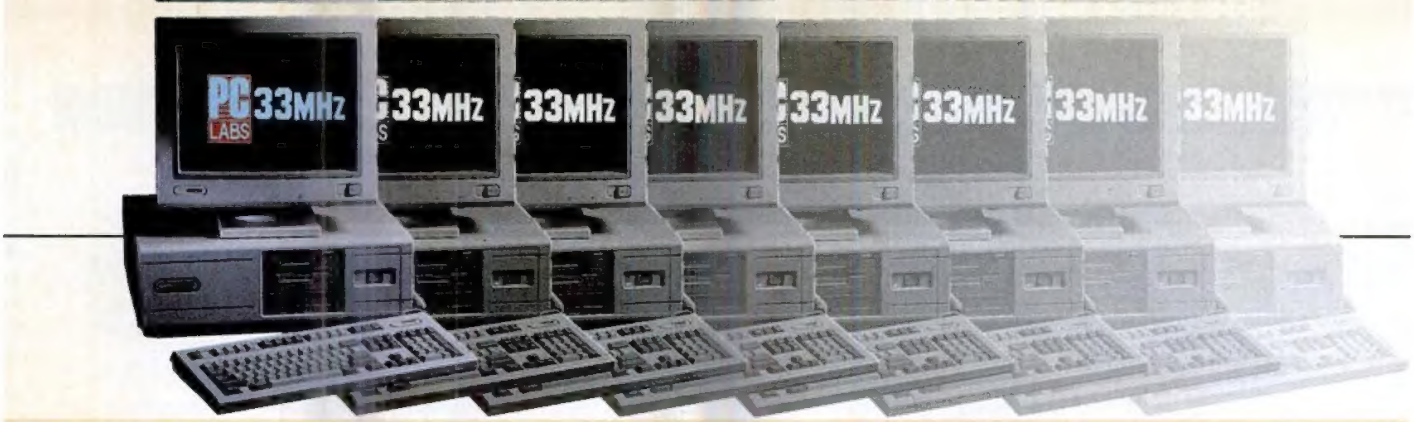
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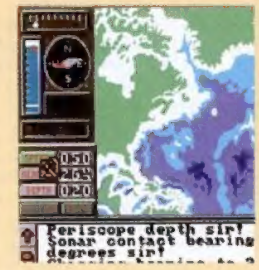
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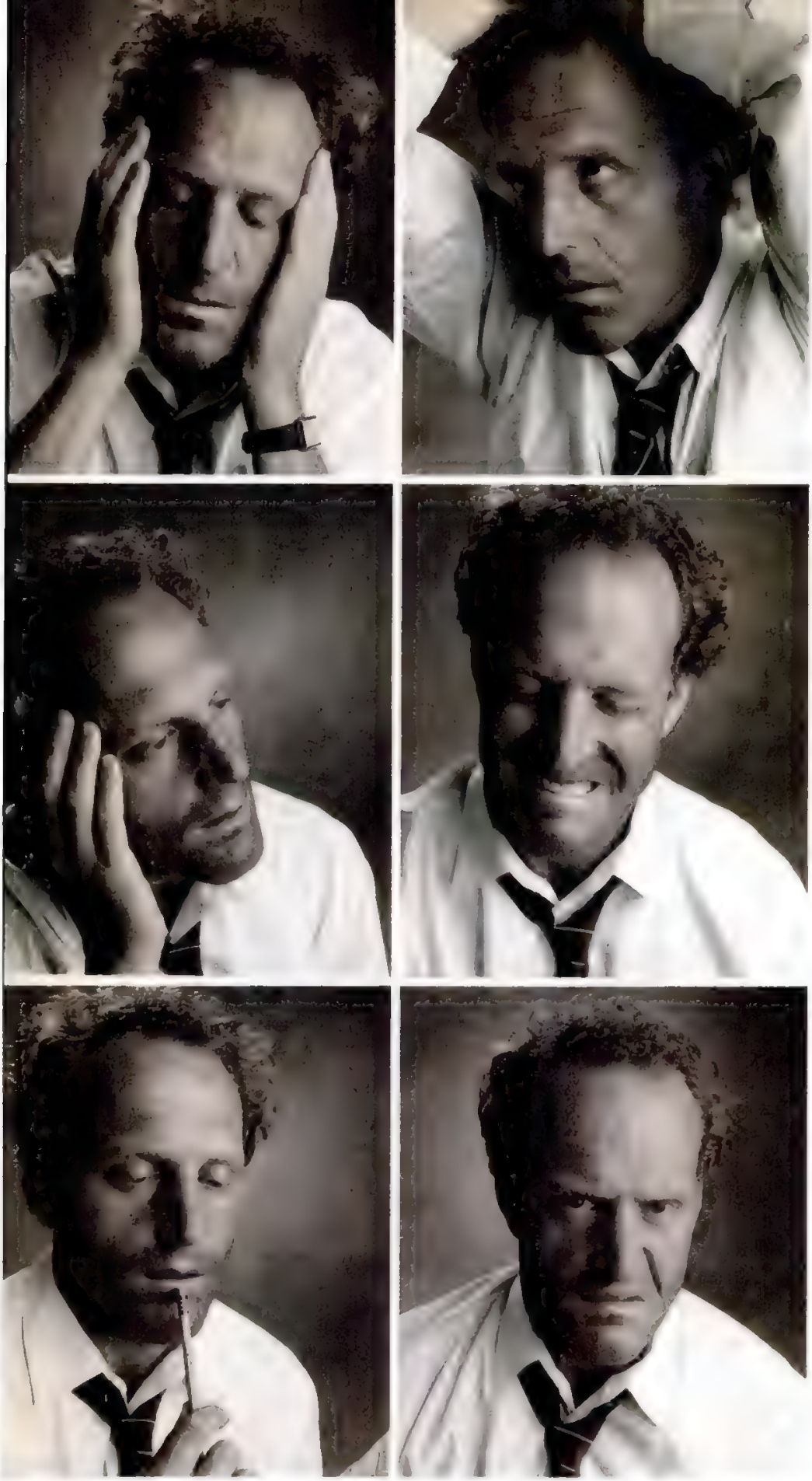
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- EMS LIMM 4.0 Support
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- IDE Hard Drive Controller Adapter
- 2 Serial Ports & 1 Parallel Port
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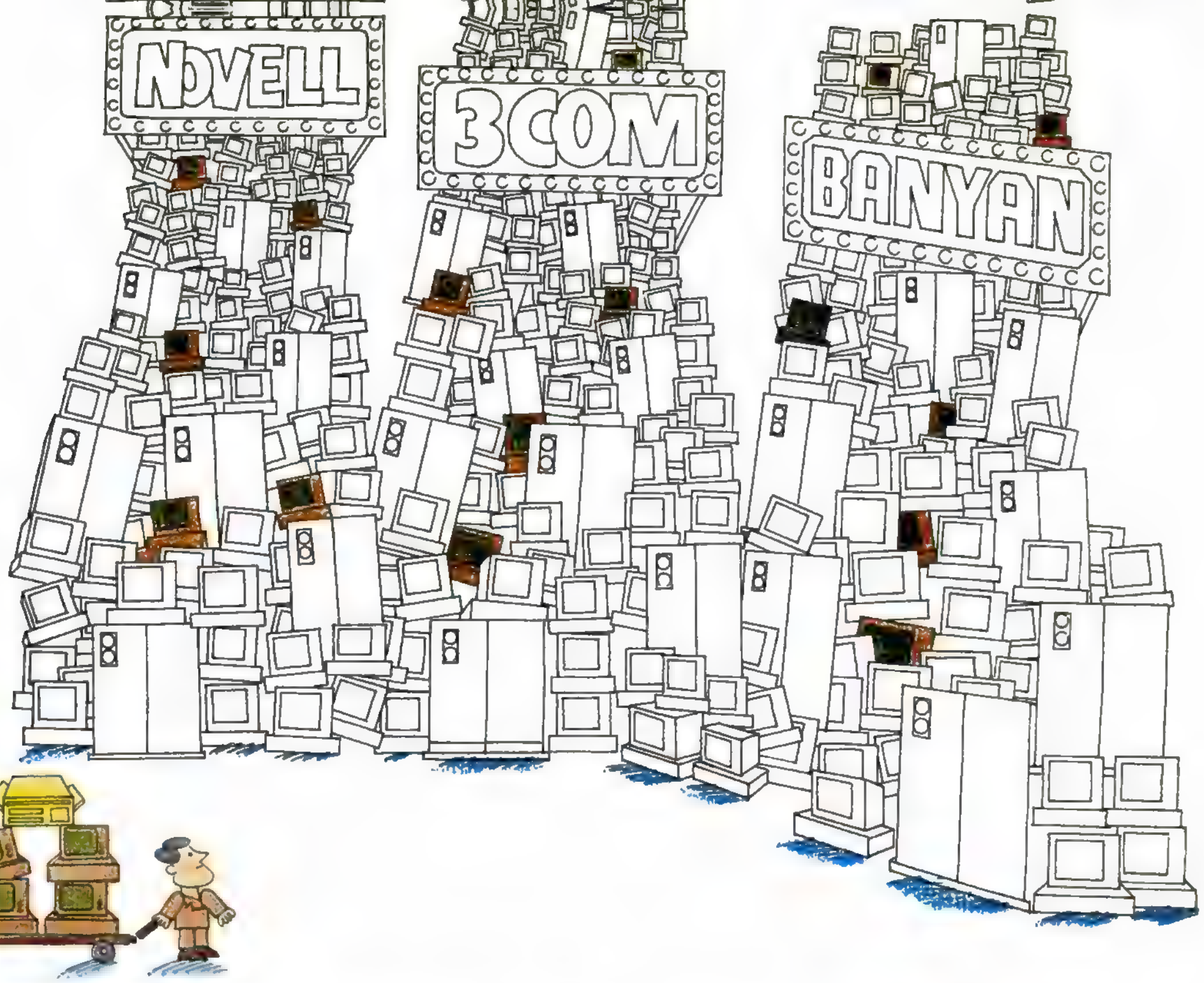


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Letters

HEAVEN CAN WAIT

Although I usually find John C. Dvorak's columns thought-provoking, his remarks in the August issue (John C. Dvorak, *PC Magazine*, August 1989) were way off base. While telling us that 8088-based PCs are obsolete, Dvorak fails to consider the very ways these machines are used.

Many small businesses use XT-class computers to run typical business programs, such as small spreadsheets, word processors, or inventory packages. In these environments, the computer is used for perhaps 15 minutes a day. Just as a typical commuter doesn't drive a Ferrari, a typical computer user doesn't need a 33-MHz 80386 screamer. Maybe Mr. Dvorak could cut the 8088 some slack and recognize it for what it is—a Chevy pickup in a world of Corvettes.

Ronald Hicks
Sheboygan, Wisconsin

Yes, 8088 and 80286 machines are slow-tech, dull, and lacking any sort of glamour, but they are far from antiques, and they still pack a lot of useful computing power. There are thousands of small businesses and nonprofit organizations around the country that can make good use of an old PC-XT. It doesn't take 8MB of memory and a color monitor to run thousands of inexpensive and invaluable software packages. Schools, too, can benefit from the 8088.

Dvorak should keep in mind that sometimes the latest technology is not required to do business effectively. A nickel pencil has always been a relatively primitive output device, but you can still write a powerful letter with it.

John Buginas
El Cerrito, California

SO WHAT IF IT'S A LITTLE SLOW?

Once again you have panned NEC, specifically the NEC PowerMate SX, in your August roundup of 14 SX-based 386 machines ("Out in Force: 14 Machines with the SX Promise," *PC Magazine*, August 1989). In that review, you state that the PowerMate SX was one of the slowest performers at one of the highest prices. You also state that the NEC machine ranked among the highest in quality and construction. One would think that this latter observation is of more importance, since many of the cheaper, faster clones are as reliable as an Italian sports car—always in the shop for repairs.

I'll take my NEC, knowing that it will stick around for a while.

Brian Welch
Springfield, Massachusetts



The 386SX computer: spelling the end for the "old" 286.

WHEN IT'S SIZE THAT COUNTS

To paraphrase John C. Dvorak, while I wouldn't call the 28 or so pages devoted to monochrome VGA monitors in your August 1989 issue completely "wasted," they do miss the point ("VGA for the Budget-Minded"). In an age of color chauvinism, the compelling reason for going monochrome is size, as in full-page (at about one-third or half the cost of a comparable high-resolution color setup).

My eyes aren't getting any younger, and I doubt that yours are, either. There's just no way I would go back to any dinky little landscape screen, Kodachrome or mono-, no matter what the savings. Ease of vision is worth infinitely more. Try a page-size monitor once and you'll see what I mean.

Dennis Stacy
San Antonio, Texas

IN COD WE TRUST

I was disappointed by your failure in the recent article on mail-order hard disks to talk straight about the best way for a mail-order customer to guarantee satisfaction ("Fast, Easy, Risk-Free: Buying Hard Disks by Mail," *PC Magazine*, June 27, 1989). It's called "cash on delivery." A $7 COD fee—and a courteous front-porch inspection of merchandise—ensures that the product I get is exactly what I ordered. I won't do a first-time mail order by any other means.

While customers are grateful to have COD, it's no secret that most mail-order houses wish it would just go away. Yes, there are those who welch on COD and cause vendors grief, but there are also countless honest customers who are happy to pay for what they order but at the same time are loath to offer cash or credit cards up front to unfamiliar names from magazine advertisements.

COD is not about to disappear, and no one who claims to represent the customer's best interest should try to ignore it. And while the mail-order houses don't like COD, almost all of them will do it. They do it because, in the long run, it pays. Ignoring or sneering at it is more likely to hurt both vendors and customers than to help them.

Tony Finch
Madison, Wisconsin

GETTING A HANDLE ON THE SITUATION

In his Counterpoint remarks about the Toshiba T1600 computer ("286 Laptops Compute en Route," *PC Magazine*, July 1989), Bill Machrone states that "the lack of a built-in handle makes a machine in

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Letters

this weight class unwieldy." This comment struck me as just a bit odd, as I was sitting next to my T1600 while reading the article, and there is in fact a handle on the computer. Actually, it's more than just a handle—it also serves as a hand rest while you type. This is a feature that should be on more laptops, as it keeps the hands from tiring so quickly.

Jeff Perriens
Washington, DC

PC MAGAZINE Contrary to Bill Machrone's statement, the Toshiba T1600 does indeed have a built-in handle at the front of the machine. *PC Magazine* regrets the error.

A SECOND LOOK

PC Magazine's feature on film recorders ("From Screen to Slide—Affordably," *PC Magazine,* February 28, 1989) contains testing and reporting errors concerning the performance of the Lasergraphics Film Recorder (LFR) and Presentation Technologies' Montage FR1 film recorders. As this is the case, your readers' ability to select and purchase equipment on the basis of objective facts has been impaired.

We are happy to learn that independent retesting by *PC Magazine* acknowledged the error: while all other machines were tested at draft quality (2,000 lines of resolution) and a limited number of colors per slide (256 for the Matrix ProColor, the Editor's Choice), the LFR and the Montage FR1 were tested at presentation quality (4,000 lines of resolution) and with 1 million possible colors per slide.

The article erroneously stated that all recorders were tested under identical conditions. Fortunately, your new testing clearly showed Lasergraphics' LFR to be the fastest film recorder of all that were tested, and the Montage FR1 to be the second-fastest.

Furthermore, we submit that it is an error to lead the reader who is new to the use of film recorders into believing that draft-quality slides are, for all intents and purposes, good enough and therefore the basis upon which equipment should be selected. In a recent conversation with *PC Magazine* executives, it was agreed that presentation slides have a resolution of 4,000 lines, not 2,000.

We at Lasergraphics and Presentation Technologies respect the Editor's Choice, subjective as that decision may be. However, in reporting the choice, some explanation should have been given for picking a film recorder that is slow and can accommodate only 256 colors in any one slide.

Dr. M. Demetrescu
Chairman and Chief Executive Officer
Lasergraphics Inc.
Irvine, California

Howard F. Earhart
President and Chief Executive Officer
Presentation Technologies
Sunnyvale, California

PC MAGAZINE *PC Magazine* inadvertently tested the Lasergraphics Film Recorder and Presentation Technologies' Montage FR1, which share a common imaging board (Lasergraphics' Rascol II) and software, at 4,000-line (4K) resolution. The other film recorders were tested at 2,000-line (2K) resolution. Retests by PC Labs at 2,000 lines show that the LFR and the Montage FR1 returned faster times than all other tested units. Retest times are shown below, in seconds (shorter times mean better performance), for creating simple and complex text and graphics slides. The 4,000-line retest times are faster than the original published times because of engineering modifications made to the units since the original review. Use the "2K (retest)" times for comparison with the original test results.

	Text 1	Text 2	Graph 1	Graph 2
Lasergraphics Film Recorder				
Published time	130	315	215	1,613
4K (retest)	86	273	186	545
2K (retest)	49	163	113	393
Montage FR1				
Published time	204	426	253	2,154
4K (retest)	122	382	217	1,057
2K (retest)	73	200	131	526

BREATHING SPACE FOR THE DIGITS

Regarding Bill Howard's Counterpoint comments about the GRiDCase 1520 ("286 Laptops Compute en Route," *PC Magazine,* July 1989), there are a couple of points we would like to clarify.

The laptop was criticized for having a keyboard with keys spaced too close to-

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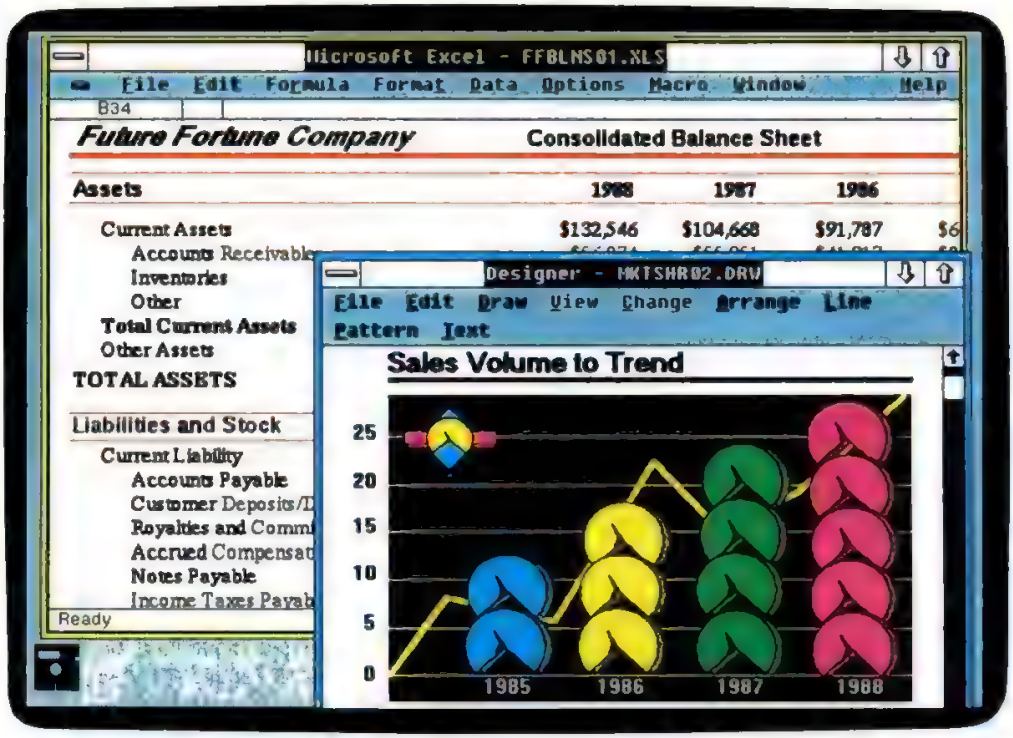
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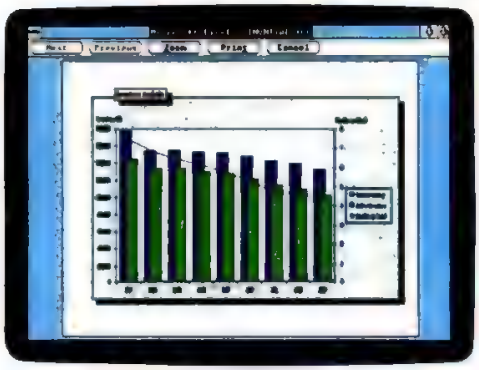
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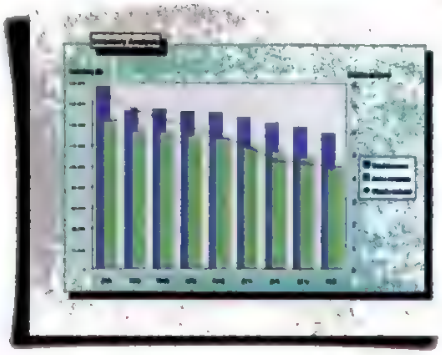
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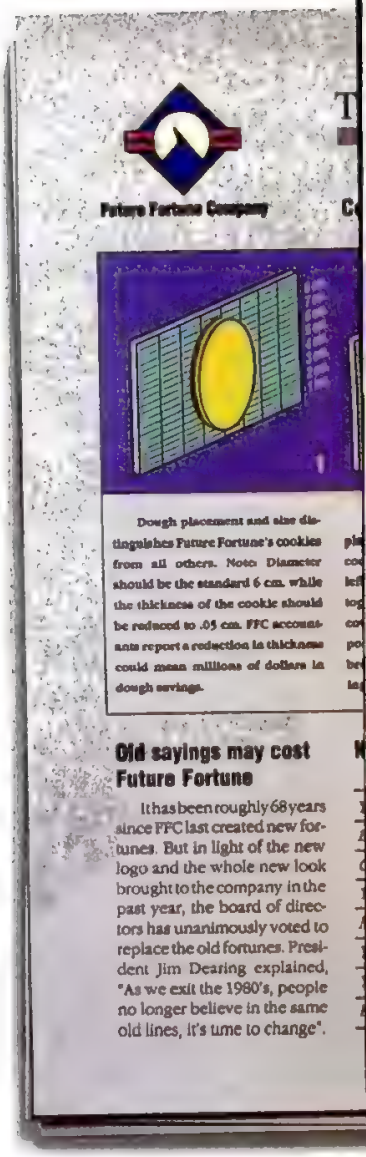
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GPPCM10.203

Letters

gether, when in fact the keys are actually positioned .25 inches apart, the same distance found on standard desktop keypads.

Furthermore, while it is true that the GRiDCase 1520 does not accommodate standard expansion cards, it does accept proprietary EGA/VGA, Ethernet, serial adapters, and 3270 cartridges that are inserted into the rear of the computer.

The GRiDCase 1535 EXP, an 80386-based laptop, accommodates one XT- and one AT-compatible expansion card.

Rich Lull
Director, Marketing Services
GRiD Systems Corp.
Fremont, California

AND ON THE SEVENTH DAY . . . IT WAS STILL PRINTING OUT

I enjoyed reading about forms-generation software in your June 13, 1989, issue ("Forms Software Fills in the Blanks"). However, I was surprised by your Editor's Choice of *Per:FORM*, a program that took 4 minutes and 50 seconds to print out a sample form.

A program that turns my 8-page-per-minute laser printer into a 5-minute-per-page laser printer is not making the best use of my investment. On the other hand, I have found that a forms compiler can create a moderately complex form that will take only a few seconds to print.

WYSIWYG appears to save time in creating a form at the cost of increasing the time it takes to print it. If I am creating a form that will be printed only 50 to 100 times, then WYSIWYG might be the way to go. But if the form will be printed hundreds or thousands of times, the extra few minutes it takes to create the form with an "ungainly" compiler will be repaid many times over.

N. C. Werner
Prince George, British Columbia
Canada

IF AT FIRST IT WON'T INSTALL . . .

I take exception to Jay Munro's letter (Letters, *PC Magazine*, July 1989) in which he claims that the automated INSTALL program for OS/2 does not work. I believe that there must be something missing from the picture he paints.

I say this because I have recently installed OS/2 on over 50 IBM PS/2 Model 70s without encountering a single problem. The automated INSTALL program worked perfectly. Then again, I used IBM's OS/2 Extended Edition 1.1 on an IBM machine. Perhaps Mr. Munro was using a version of OS/2 from a hardware manufacturer that was not as thorough as IBM in its installation routines.

Richard Curry
Garland, Texas

LEARN LOTUS AND FLATTEN THAT STOMACH

John Dvorak sure hit the nail on the head in your August 1989 issue (Inside Track) when he talked about how to do weight training with computer books.

I thought these tomes were really getting heavy when I purchased Miriam Liskin's *Advanced dBASE Programming* at 901 pages. Then I picked up Greg Harvey's *Lotus 1-2-3 Desktop Companion*, which weighs in at 976 pages.

But the one that finally did it was none other than *PC Magazine*'s own *DOS Power Tools*. This cube of a book contains 1,275 pages *and* a floppy disk!

Jack Thompson
Arlington, Virginia

C-ING IS BELIEVING

Congratulations on producing utilities and source listings using the C language. I'm pleased to see that you're adopting this wise policy for a language that is so popular in today's computer world.

Jay Rogers
Winston-Salem, North Carolina

CORRECTIONS & AMPLIFICATIONS

Because of a production error, the following line

```
SHELL=COMMAND.COM  P  /E:320
```

was omitted from the letter "Getting a Handle on the DOS Environment" in the September 12, 1989, Tutor column.

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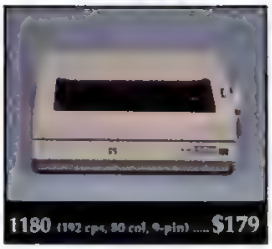
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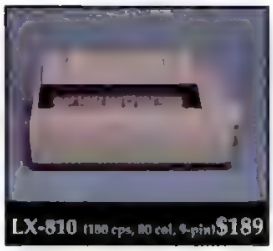
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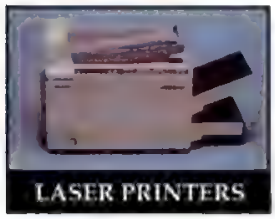
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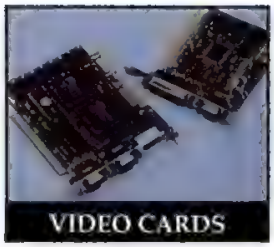
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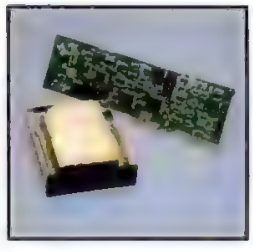
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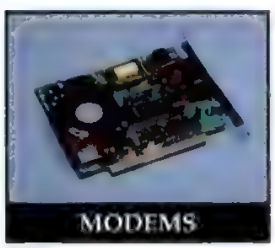
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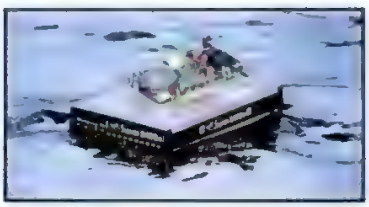
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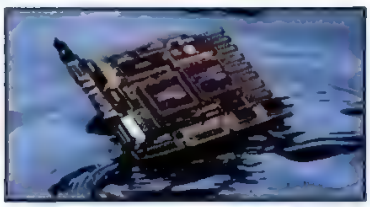


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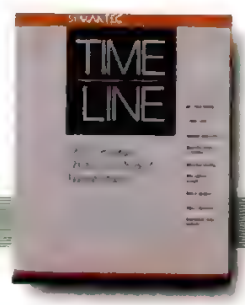
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by Lori Grunin

Advisor

TOSHIBA BACKLIGHT

I heard about a backlight retrofit for the Toshiba T1000 but have been unable to find any information about it. Can you provide any details?

B. Eugene Beyt, Jr.
Lafayette, Louisiana

The backlight retrofit you're talking about is the Thin E/L from Axonix Corp. (2257 S. 1100 East St., #2C, Salt Lake City, UT 84106; (801) 466-9797, orders (801) 582-9271). You send the machine to Axonix, and for $295 they open up the LCD screen, chemically remove the reflective layer, and install an electroluminescent light panel. They also wire in converters to transform AC power into DC and put in a sliding switch that allows you to dim or shut off the backlight. The retrofitting process takes five days and adds about 2 ounces to the weight of the machine. According to Axonix, the phosphors in the new panel have a life span of 15,000 hours.

The panel uses more power, shrinking the battery life by about 50 percent. Axonix offers a $79.95 battery upgrade that boosts it to approximately 3 hours; the new battery adds another 4 ounces.

After the retrofit, however, the display with the backlight turned off is decidedly worse than the original, since they've removed the reflective layer.

QUICK PRINTING UNDER WINDOWS

We are a small public radio station that puts together a monthly program guide on a PS/2 Model 30-021 using *PageMaker* 3.0 with *Microsoft Windows*. We print the page proofs—text only—on an HP LaserJet II with a 1MB expansion board.

Our problem is that it can take up to 30 minutes for the LaserJet to print one page. Since the program guide is 36 pages, that means 18 hours to print all the page proofs. Is the computer the bottleneck, meaning an upgrade to a 286 or 386 machine is necessary? Or is there a software program that will speed up the works? Is there a relatively inexpensive solution to our problem?

Frank Baker
Pittsburg, Kansas

- TOSHIBA BACKLIGHT: Backlighting your Toshiba T1000's LCD display.
- QUICK PRINTING UNDER WINDOWS: Improving upon Microsoft Windows' print spooler.
- FROM APPLE DOS TO MS-DOS: Reconciling the Apple II and your PC.
- WANG-TO-PC WP: Converting Wang word processor files to DOS-based ones.

First, if you haven't already done so, turn off the *Windows* print spooler—it's notoriously slow. Output speed depends on how fast the page gets processed, how quickly it gets to the printer, and how fast the printer can produce the page. In other words, the speed depends heavily on your system's CPU and your spooling software.

The next thing to try is installing LaserTool Corp.'s software print spooler, *LaserTORQ* ($99; 5900 Hollis St., Suite G, Emeryville, CA 94608; (415) 420-8777, (800) 346-1353). *LaserTORQ* sits in approximately 19K of your computer's memory and will let you use extended or expanded memory, as well as conventional memory, for a print buffer—the place where the computer stores pages until the printer is ready for them.

Normally, a spooler will send data through the computer's parallel port to the printer at regular intervals, regardless of the speed with which the printer can receive it: this speed is usually an estimate on the part of the developer and can sometimes result in bottlenecks.

LaserTORQ, on the other hand, checks the port's readiness before sending data, thereby eliminating bottlenecks and optimizing the data transfer rate. Therefore, if your printer connects to your system's parallel port, you can get a pretty good boost in speed with *LaserTORQ*.

Although serial ports automatically perform this sort of status query, sending data serially is inherently much slower—serially transmitted data moves one bit at a time, as opposed to parallel's one 8-bit *byte* at a time. So if you're serially connected, you won't see as much of an improvement.

Once you've checked out *LaserTORQ*, if you still find the process unbearably slow, then it's time to think about upgrading your machine. If you don't want to spring for a whole new system, you can get an 80286 accelerator card, such as the SOTA286i (SOTA Technology Inc., 657 N. Pastoria Ave., Sunnyvale, CA 94086; (408) 245-3366) for $445. An upgrade like this will provide the additional benefit of boosting *PageMaker*'s pokey pace.

FROM APPLE DOS TO MS-DOS

I'm looking for information about a coprocessor board for a PC that will allow me to run Apple II programs and read files generated by that machine. I'd prefer to upgrade my machine somehow rather than be forced to purchase one of the slowest computers currently on the market.

Lisa Smythe
Los Angeles, California

To begin with, what you decide to do depends on which Apple II machine you're talking about. If you need to interface with the Apple II GS, then you're limited to sharing files. Since the II GS uses a Motorola 65816 processor instead of the 65C02 used by the other

machines of the Apple II series, existing hardware and software emulators can't run II GS software—at least until someone decides it's worth the effort.

If that's your predicament, and your PC is near the Apple, you can use Softspoken Co.'s *Cross-Works* to transfer your files from one to the other, as well as convert them to various word processor, spreadsheet, and database formats ($79.95; P.O. Box 97623, Raleigh, NC 27624; (919) 878-7725). You connect the two machines via their serial ports; unfortunately, the transfer takes place at a slow 19K bps.

On the other hand, if the other Apple IIs are your concern, then Diamond Computer Systems (470 Lakeside Dr., Sunnyvale, CA 94086; (408) 736-2000) makes a full-length 8-bit board for your PC (but not Micro Channel PS/2) that will let you run most of the Apple II series' software as well as read and write to the disks. The software that might present problems are copy-protected packages that require a genuine Apple II floppy disk drive to run.

The Trackstar E and the Trackstar Plus 2.0, which cost $445 each, have two 65C02 processors and 128K of on-board memory, as well as a floppy disk controller that gives your PC's drive Apple II compatibility. Trackstar's software will also let you partition your PC's hard disk drive to hold both PC and Apple II programs. In addition, you can hotkey between MS-DOS and Apple programs.

If you've got a system with TTL video output or VGA and an autosynchronizing monitor, then you'll want the Trackstar E; analog monitors and PS/2 Model 25s need the Trackstar Plus.

WANG-TO-PC WP

We need to convert documents created on a Wang word processing system into a PC word processing format. The Wang system can copy documents to an MS-DOS disk, except the files are in Wang PC word processing format. Do you know of any PC-based conversion software that will convert from Wang PC format to another word-processing format (*WordStar, MultiMate, WordPerfect,* and so on)?

Jonathan Golberg, Capt., USAF
Offutt AFB, Nebraska

To translate your files, you don't have much of a choice: Systems Compatibility Corp.'s *Software Bridge* ($199; 401 N. Wabash, #600, Chicago, IL 60611; (312) 329-0700, (800) 333-1395) is the only software package that handles the Wang word processor format. Luckily for you, when *PC Magazine* reviewed format conversion software in the April 25, 1989, issue, *Software Bridge* fared well enough to earn an Editor's Choice; although the slowest of the four software packages tested, it was the most accurate.

With *Software Bridge*, you have the option of translating to *Microsoft Word, MultiMate, WordPerfect, WordStar,* and several other word processors, as well as intermediate formats such as ASCII and DCA RFT (Document Content Architecture Revisable Form Text).

ASK THE ADVISOR

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	80386 Instruction Mix	Floating Point Calculation	Conventional Memory
ZEOS 386/25 Desktop	2.29	8.37	0.33
ZEOS 386/33 Desktop	1.67	6.43	0.27
IBM PS/2 Model A	2.27	8.33	0.60
Compaq Deskpro 386/25	2.36	8.59	0.37

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First Looks

Hands-on Reviews of the Latest Products

NEC Breaks New Ground With First Color Portable

PREVIEW

The evolution of the PC has been marked by many milestones. This October establishes yet another one, assuming NEC has shipped its ProSpeedCSX on schedule. The ProSpeed has the distinction of being the first portable PC to boast a color display and the first PC, portable or otherwise, to sport a color LCD screen.



The 386SX-based ProSpeed comes in an 18.5-pound clamshell package. Including its handle, the machine measures about 16 inches deep, 15 inches wide, and 4 inches high. You can balance the system on your lap if you really must, but you'll need an electrical outlet close by if you do; one of the caveats of color LCD technology, for the time being at least, is the power-hungry nature of the high-intensity backlighting it requires.

Like other color-screen laptops you can expect to see in the not-too-distant future (see the sidebar "The NEC ProSpeedCSX Stands Alone—But Not for Long"), the ProSpeed won't come cheap. The base configuration—complete with 10-inch, 16-color display; 42MB hard disk; and 2MB of RAM—will carry a list price of $8,499. Other standard features include a 1.44MB floppy disk drive, built-in serial and parallel ports, and connectors for an external VGA monitor and floppy drive. Two proprietary option slots make room for a 1,200-bit-per-second internal modem and an additional 2MB of RAM.

NEC's lunch-box ST, the PowerMate SX, which is similarly equipped save for its monochrome display, lists at $6,595. Assuming other costs are roughly the same, the step up to color adds about $2,000 to the cost of the ProSpeed.

NEC and every other company involved in color LCD research and development, a bunch that by and large doesn't like to talk about color LCD costs, will no doubt be watching closely to see whether buyers are willing to foot the bill for early stabs at color LCD technology. Unfortunately, if our evaluation unit—a late prototype—is any indication, the decision may not be an easy one for all but the most color-hungry travelers.

To get a handle on color LCD, it's important to draw a distinction between the two types of displays every major

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MultiScope: The OS/2 Debugger that PM Forgot?

HANDS ON

by Richard Hale Shaw

Debugging programs under OS/2 is generally less hazardous than doing so under DOS. Unfortunately, OS/2 debuggers are little more than ports of their DOS predecessors, and they certainly don't take advantage of the Presentation Manager's graphical user interface. The arrival of Logitech's *MultiScope OS/2 Debugger*, however, has advanced the state of the art. The $299 program makes it easy to view and manipulate a program, set and clear watchpoints, and display the program environment from nearly every perspective.

MultiScope is compatible with all OS/2 languages whose compilers produce CodeView-compatible debugging information. This includes Microsoft and IBM's C, Pascal, assembler for OS/2, and Logitech's Modula-OS/2.

The package contains two types of debuggers. One is a runtime debugger that can interactively step or trace through a program while the program runs; the other is a "postmor-

CONTINUES ON PAGE 34

PHOTOGRAPHY: THOM O'CONNOR

MultiScope

CONTINUED FROM PAGE 33

tem" debugger that saves the state of the program to a file and helps you find a problem after the program crashes.

You need only add a single line of source code to your program to use the postmortem debugger. This doesn't alter the source or object code of the program in any fundamental way; it's a function call that starts the postmortem debugger in another OS/2 session.

Because of a Presentation Manager limitation, you must run a character-mode debugger in an OS/2 full-screen window when debugging a PM program. Thus, four programs are included in the *MultiScope* package, since character-mode and PM versions of both types of debuggers are provided.

MultiScope's innovative interface sports 13 windows for controlling and monitoring the state of your program as it runs. Assembler and Source windows let you view your program in assembly language; in its original, high-level-language source code (C, Pascal, Modula-2); or in a mixture of the two. The Data window automatically displays the contents of global and local variables as you step through the program, letting you modify them on the fly.

With *MultiScope*, it's a cinch to create program breakpoints, where the debugger will interrupt program execution if a specified condition is met or a selected line of code is reached. You can scroll or jump to specific lines or procedures of your program in the Source window and then use pull-down menus to set or clear breakpoints. The Source window lets you trace through your program, stepping across or into procedures. Another pull-down command lets you run the program to the end of the current procedure and return to the calling function.

Program watchpoints—variables whose contents are displayed as the program runs—can be set and cleared with a mouse click. By controlling the "granularity" (the frequency with which watchpoints are checked) in the *MultiScope* Watchpoint window, you can find out where a variable changes in a few passes through the program. With each pass, you can narrow the granularity, so that checking occurs at procedure entry and exit points or upon the execution of any source statement or assembly language instruction.

MultiScope's Graphic window lets you generate a graphical display of selected variables, including linked lists and arrays of structures. Each member of an array and its components are displayed in the Graphic window. But that's not the only way to view complex variables. Just double-click on an array name in the Data window and *MultiScope* will display a table of its elements. Click on an element and its contents will be displayed. With a few more mouse clicks, you can traverse a linked list or several structures in an array.

MultiScope makes it easy to debug multithreaded programs. They're difficult enough to write in OS/2; each thread of execution maintains its own stack and CPU registers like a small program that runs parallel to the main program. It's often impossible to know exactly what source-code lines each thread is executing at a given point without setting innumerable breakpoints. But with *MultiScope*'s Thread window, you can switch from thread to thread at will.

The Thread window contains a table of your program's threads with each thread's ID, status, and priority. If you click on a thread's entry in the window, the Source and Data windows are updated to contain the thread's code and variables, and the executing source line is highlighted.

You can also suspend threads at any time. Even multiprocess debugging, in which your program runs another program, is easier to do. You can instruct *MultiScope* to start another copy of itself and debug both programs.

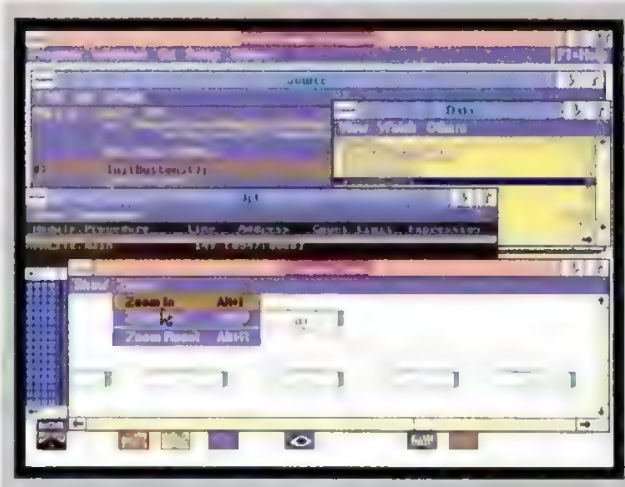
Other *MultiScope* features include a Register window, which displays the contents of the CPU, and a Call window, which maintains a hierarchical list of the functions called by the program. In addition, there's an on-line Help window, a window that tracks program source-code modules, a memory display window, and a Log window to track the commands you issue and the messages generated during the debugging session.

If you don't like the colors, sizes, or arrangement of the program's windows, you can change and save them at any time. Further customization of *MultiScope* is possible with a configuration file; this contains a series of commands that are automatically executed when you start the debugger.

MultiScope supports dual-monitor debugging so that you can display the debugger on one monitor and your application on another. You also can run the debugger on one computer and the application on another, allowing for a complete separation of execution environments.

MultiScope does have a few minor limitations. The program is too dependent on the use of the third mouse button; perhaps the authors assumed that you would use a Logitech mouse. In addition, you can't display any of the windows outside of the debugger's main window frame. When you shrink the main window, the others are constricted inside it. It would be useful to have access to a few of the debugger's windows alongside other windows on the Presentation Manager's desktop screen.

These small faults aside, *MultiScope OS/2 Debugger* is the debugger that should have been included with the Presentation Manager. The program's innovative interface, coupled with its powerful and thoughtful selection of features, will probably change your programming habits for the better. ■



MultiScope's windowing interface offers pull-down windows and 13 ways of looking at your program. Counterclockwise from the upper left are the program's source code, the breakpoint window, the window for displaying program data graphically, and the program data window. Other MultiScope window icons are displayed across the bottom of the screen.



FACT FILE

***MultiScope OS/2 Debugger*, Version 1.0**
Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; (415) 795-8500.
List Price: $299
Requires: 3MB RAM (4MB or more recommended), 2.5MB hard disk space, OS/2 1.1 (Standard or Extended Edition).
In Short: An OS/2 debugger that makes it easy to view and manipulate a program, set and clear watchpoints, and display the program environment from nearly every perspective. A must for OS/2 programmers.

CIRCLE 447 ON READER SERVICE CARD

PROSPEEDCSX

CONTINUED FROM PAGE 33

development effort is exploring. Both achieve color by placing a layer of red, green, and blue color filters (tints) over each pixel. The difference lies in how the displays control the liquid crystal to illuminate the pixels.

The most promising technology, and the one that drew crowds of admiring spectators at the most recent Comdex, is thin film transistor (TFT) active matrix. TFT LCD displays not only solve the two biggest problems with traditional LCD technology—lackluster speed and a narrow viewing angle—but also offer picture quality unrivaled by even the best CRT displays.

Companies have produced and demonstrated enough of these startling displays to convince people that LCD really will revolutionize video electronics—but mass-producing the displays is a much bigger challenge. TFT LCD displays use a thin layer of transistors and dedicate at least one transistor to the control of each red, green, and blue dot. With three dots per RGB pixel and a resolution of 640 by 480, a 10-inch TFT display would call for a minimum of 921,000 transistors in a continuous 10-inch layer.

As yet, no vendor has quite mastered the trick of manufacturing such a layer in high-enough yields to make color TFT profitable in anything but the tiny portable TVs that Sony and Sharp are successfully marketing.

The second technology—and the one used in the ProSpeed's 10-inch display—builds on the less glamorous double supertwisted nematic (DSTN) design already used in page-white laptop screens. Double supertwisted displays work on the same principles as the more familiar supertwisted version but eliminate the blue and green tints created by the single supertwist. The individual display dots are controlled by grids of electrodes rather than dedicated transistors.

The advantage of color DSTN technology is that it is relatively easy to produce. The disadvantages are its lethargic nature, comparatively low contrast ratio (15:1 for a typical display versus 40:1 or better for TFT displays), and washed-out colors. Picture quality has grown better and will undoubtedly continue to improve, but a typical color DSTN LCD still doesn't fare well in comparison to a color CRT, much less a TFT LCD.

How does the ProSpeedCSX compare? While it's difficult to pass final judgment when working with a prototype—NEC was still cleaning up the display as this issue went to press—even the production units are sure to be disappointing if you're expecting a display as vibrant and responsive as your desktop's. Images seem almost to fade onto the screen, and any attempt at animation—moving your cursor rapidly across the screen, for instance—results in obvious ghosting.

Colors tend to be fairly true, but the display as a whole, and the black background in particular, looks washed out. The screen on our preproduction evaluation unit also seemed blotchy and had problems with vertical color bleeding, but this is the type of problem one would expect NEC to solve before shipping the machine.

With a resolution of 640 by 400, the display also falls short of VGA compatibility, though its resolution and 16 colors (out of a palette of 64) do a nice job with EGA. In addition to MS-DOS 3.3, NEC will ship its own version of *Microsoft Windows/386* with every ProSpeedCSX. *Windows* and a slow LCD don't make for a

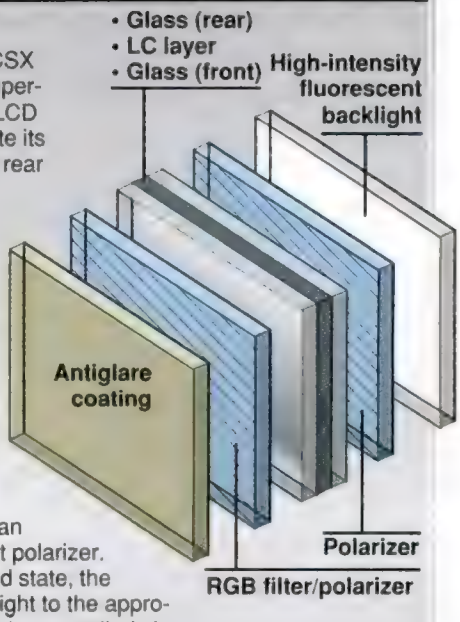
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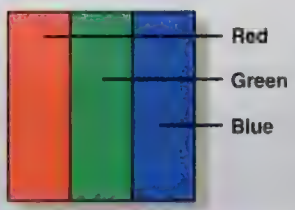
The ProSpeedCSX's 10-inch, 16-color display is based on a double supertwisted nematic design.

HOW THE NEC ProSpeedCSX GENERATES COLOR

The NEC ProSpeedCSX builds on standard supertwist-nematic (STN) LCD technology to generate its 16-color display. The rear polarizer allows only light oscillating in one plane to pass through. The front polarizer allows only light oriented in a perpendicular plane to pass through. In between, the orientation of the liquid crystal molecules determines whether the light is reoriented so that it can pass through the front polarizer. In their natural, twisted state, the molecules guide the light to the appropriate angle. With a voltage applied, the molecules straighten, leaving the corresponding pixel dark.



To generate color, the display triples the number of dots, or actual pixels, and incorporates red, green, and blue filters into the front polarizer. The filters work just like tinted glass, and each set of three corresponds to one effective pixel. By turning the colors for each pixel on or off in all possible combinations, the display can produce eight colors—black, white, red, green, blue, cyan, magenta, and yellow. Additional shades and colors can be produced by varying the rate at which the individual dots are activated.—*Mitt Jones*



The NEC ProSpeedCSX uses the spatial color technique for generating color. Each pixel on the RGB filter/polarizer has three selectable color areas.

Copyrighted materia

PROSPEEDCSX

CONTINUED FROM PAGE 35

speedy duo, but the pairing does work.

The display's viewing angle seemed surprisingly wide for an LCD. The display remains strong up to angles of about 30 degrees, and the image was readable, if barely, even from 45 degrees.

For presentations that involve more than a couple of people, you'll still need a good old-fashioned CRT, and the ProSpeedCSX will accommodate you here as well. The machine makes use of Chips and Technologies' 82C455 flat-panel video controller, and this controller, supports both the internal LCD and an external VGA monitor.

All in all, the ProSpeedCSX should prove to be an impressive machine. The color LCD screen won't bowl you over with remarkable picture quality nor will it startle you with blazing speed, but it does display 16 simultaneous colors, which is a feat in itself for a portable-computer screen.

If you can live without a color-screen portable for the time being, you're probably better off waiting for color LCD prices to drop and for other manufacturers to make their move. In the meantime, however, the ProSpeedCSX is the only game in town for those who need color graphics in a DOS-to-go machine now.

One bit of advice: If you decide the ProSpeed is the traveling companion you've been waiting for, you'd better snatch one up when you find it. While NEC doesn't expect a large market for an $8,499 color portable, it does expect demand to outstrip supply. ■

FACT FILE

NEC ProSpeedCSX
NEC Information Systems Inc., 1414 Massachusetts Ave., Boxborough, MA 01719-9988; (508) 264-8000.
List Price: With 2MB RAM, 42MB hard disk, $8,499; 100MB model with 10-MHz ESDI interface, $9,499.
In Short: The first color LCD portable offers 16 simultaneous colors in an 18.5-pound package. Prototype shows promise despite its rather washed-out screen.

CIRCLE 445 ON READER SERVICE CARD

THE NEC PROSPEEDCSX STANDS ALONE—BUT NOT FOR LONG

by Mitt Jones

It's no accident that the list of companies investing in color LCD research and development reads like a *Who's Who* of Japan-based consumer electronics giants: Sharp, Sony, Toshiba, Mitsubishi, Sanyo, Hitachi, and NEC. Imagine a 25-inch television screen thin enough to hang neatly on your family-room wall and you've got the future just about right.

That vision, and the money companies stand to make from it, is the impetus behind the tremendous research effort being devoted to color LCD technology. The technology is still too expensive to take to the consumer market on such a large scale, but the research is beginning to pay off in the form of color screens for DOS portables—a market that offers the deep pockets sizable LCD products still require.



The Sharp PC-8000 will feature a 14-inch, DSTN, color LCD screen.

Sharp was the first company to announce a color-screen portable, the PC-8000. Though it now looks as though the NEC ProSpeedCSX will ship first, Sharp will probably still claim bragging rights to the first VGA-compatible color laptop.

While the NEC's screen measures about 10 inches diagonally and falls short of VGA resolution, with 640 by 400 pixels, the Sharp PC-8000 will feature a 14-inch, DSTN LCD with a resolution of 640 by 480. The screen will display 16 simultaneous colors from a palette of 512.

Sharp has yet to set a list price for the machine, or even a firm shipment date. One spokesman said that a first-quarter-1990 shipping date might be a reasonable expectation.

Sharp is also aggressively pursuing TFT technology. The company has been showing a 14-inch TFT LCD model capable of displaying 512 simultaneous colors. *PC Week* reported in September of last year that Sharp hoped to market its 14-inch TFT display in America in early 1990, but Sharp declines to estimate a shipping date now.

NEC also declines to divulge specific plans for a TFT screen, but a company spokesman did point out that the ProSpeedCSX was designed to allow removal of the DSTN display. A VGA version of the DSTN display is also in the works.

Hitachi reports that it is successfully mass-producing a TFT display for laptop use. While the display quality rates no less than wonderful, the screen measures a scant 6.3 inches diagonally and offers no better than CGA graphics—eight colors at a resolution of 640 by 200.

Zenith acknowledges reports that it has built a prototype portable that uses the Hitachi LCD panel, but a spokesman echoed the widely held belief that anybody willing to pay the premium for a color portable will want top-of-the-line features, including VGA graphics. Neither Hitachi nor any other company has announced firm plans to integrate the screen into a laptop.

Mitsubishi has also joined the fun, showing a 10-inch-diagonal, TFT LCD capable of displaying eight colors at a resolution of 640 by 480. The company divulged no definite plans to market a laptop based on the design.

One of the most promising developments came as this issue was going to press, when Toshiba and IBM Japan announced a joint venture aimed specifically at mass-producing a TFT LCD that the companies developed in another collaborative effort. The joint venture will operate under the name Display Technologies and will first manufacture a 10-inch VGA display that will be sold to both IBM and Toshiba for use in their PC and workstation products. The bad news is that production isn't scheduled to begin until April 1991. Neither company is talking about other color LCD products that may be ready before then.

Of the many companies at least speculating about marketing a color LCD laptop, no vendor is talking about building a display into anything less than a 386SX-based machine. That may change when and if color LCD prices fall, but at least for the time being, no manufacturer is willing to take a chance on adding a few thousand dollars to the cost of even a 286-based laptop for the sake of color. If you're determined to travel with a color portable, be prepared to pay for it.

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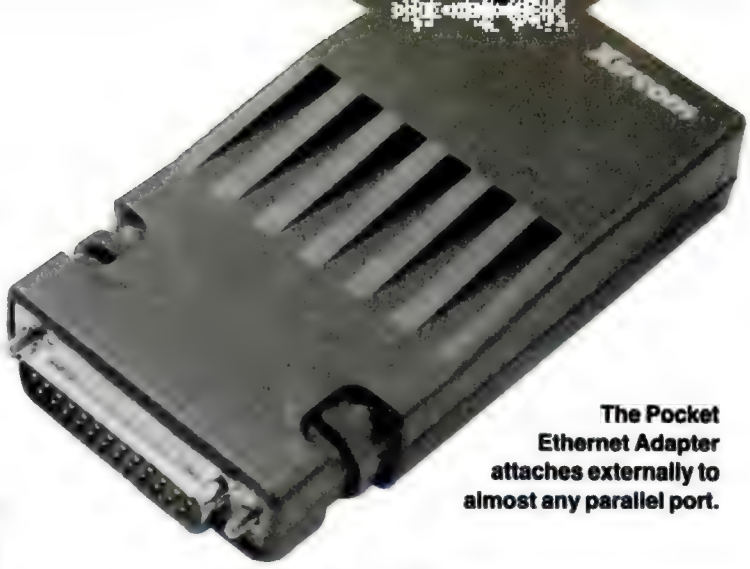
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CIRCLE 299 ON READER SERVICE CARD

Laptops Acquire Hassle-free Connectivity to NetWare Networks with Pocket Ethernet Adapter



The Pocket Ethernet Adapter attaches externally to almost any parallel port.

HANDS ON
by Frank J. Derfler, Jr., and Kimberly Maxwell

Until now, putting a laptop PC on a local area network without limiting its portability hasn't been an easy thing to do. Pure Data sells network adapters that slide into the modem slot on a few portables, but because the installation is difficult, you almost have to decide whether you want the network adapter to be a permanent fixture in your machine.

There is also Connect Computer's WonUnder, which lets you add any type of PC card, including a network adapter, in a special cabinet slung under the portable. But the cabinet and wiring take up space and don't work with every PC. And though Toshiba puts an internal Ethernet adapter on certain models of its laptops, not everyone who wants to use a laptop on a network wants to buy a new Toshiba.

Xircom's Pocket Ethernet Adapter gives people who use laptop and desktop computers a convenient and compact way to connect to a NetWare network running over Ethernet without having to install internal hardware. This 5-ounce gray box, which costs $695, attaches externally to almost any PC parallel port, making it a breeze to connect to an Ethernet cable. An external AC power supply eliminates the need to steal power from the host PC. You can slide the Xircom adapter into a desk drawer or leave it attached to the Ethernet cable when you take your laptop on the road.

Xircom produces two models of the Pocket Ethernet Adapter: one for thin Ethernet and the other for an external Media Attachment Unit or transceiver that can attach to twisted-pair, fiber-optic, or thick Ethernet cabling. The Pocket Ethernet Adapter is compatible with Toshiba, Zenith, NEC, Compaq, and GRiD portables and with any Sharp machine that has a standard parallel port. NEC UltraLite users will have to look for another solution, however, because that machine doesn't have a parallel port.

The floppy disk in the Xircom package comes with *NetWare* IPX drivers for LPT1, LPT2, and LPT3. Since the Pocket Ethernet Adapter has no configuration switches, you don't have to deal with problems of I/O address and interrupt conflicts that are common in most network cards. You use the adapter's big, knurled knobs (why can't all connectors have them?) to attach the Pocket Ethernet Adapter to the parallel port and run the appropriate IPX driver. Then you run the *NetWare* NET program for your version of DOS and log on to the server.

Xircom has drivers for 3Com Corp.'s *3+Share*, TCP/IP, and NetBIOS under development, but right now the adapter works only with *NetWare*.

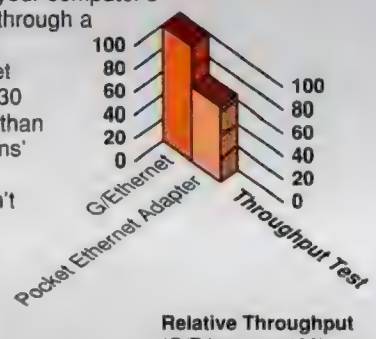
The installation disk includes a diagnostic program that quickly tells you if the Pocket Ethernet Adapter will operate through a particular parallel port. The troubleshooting section of the very complete manual gives suggestions on how to respond to five different error messages.

Because Xircom's adapter works through the parallel port instead of through specialized adapter-card hardware, it takes about 30 percent longer to move information to and from the server. However, you probably won't be able to tell the difference without measuring it with a stopwatch on a large file transfer. The speed of file transfers and many other actions is limited more by the seek time of the disk drives on the client PC than by the network adapter. The Pocket Ethernet Adapter provides a high-speed connection suitable for any network client-station task.

Although the Pocket Ethernet Adapter costs nearly twice as much as an equivalent Ethernet card, it can be a very good investment for anyone who needs Ethernet service but doesn't have a slot for an Ethernet card. Its design provides adequate performance and great convenience. ■

BENCHMARK TEST: XIRCOM POCKET ETHERNET ADAPTER

Since it moves data via your computer's parallel port rather than through a dedicated network card, Xircom's Pocket Ethernet Adapter provides about 30 percent less throughput than Gateway Communications' G/Ethernet card. In practice, though, we don't think you'll notice the difference; the service this adapter provides is fast enough for practically any network task.



Relative Throughput
(G/Ethernet = 100)

Throughput Test	Throughput (kilobits per second)
G/Ethernet	459.70
Pocket Ethernet Adapter	297.40

The **Throughput** test, part of our LAN benchmark test suite, transfers a 1MB data file 15 times using block sizes of 512 bytes, 4K, and 16K. The reported throughput represents an average for all trials.

These tests were conducted using a Dell Model 200 with a 12-MHz 80286 as the client station. The server was a Core International ATB386T running an 80386 processor at 20 MHz.

FACT FILE

Pocket Ethernet Adapter
Xircom, 22231 Mulholland Hwy., #114, Woodland Hills, CA 91364; (818) 884-8755.
List Price: $695 (thin Ethernet or external MAU version).
Requires: A parallel port on the host and a Novell NetWare server running *NetWare* 2.1 or later.
In Short: A small external device that uses the parallel port of a PC or laptop to provide Ethernet service on Novell networks. Gives throughput adequate for practically any client-station task and installs in seconds.

CIRCLE 435 ON READER SERVICE CARD

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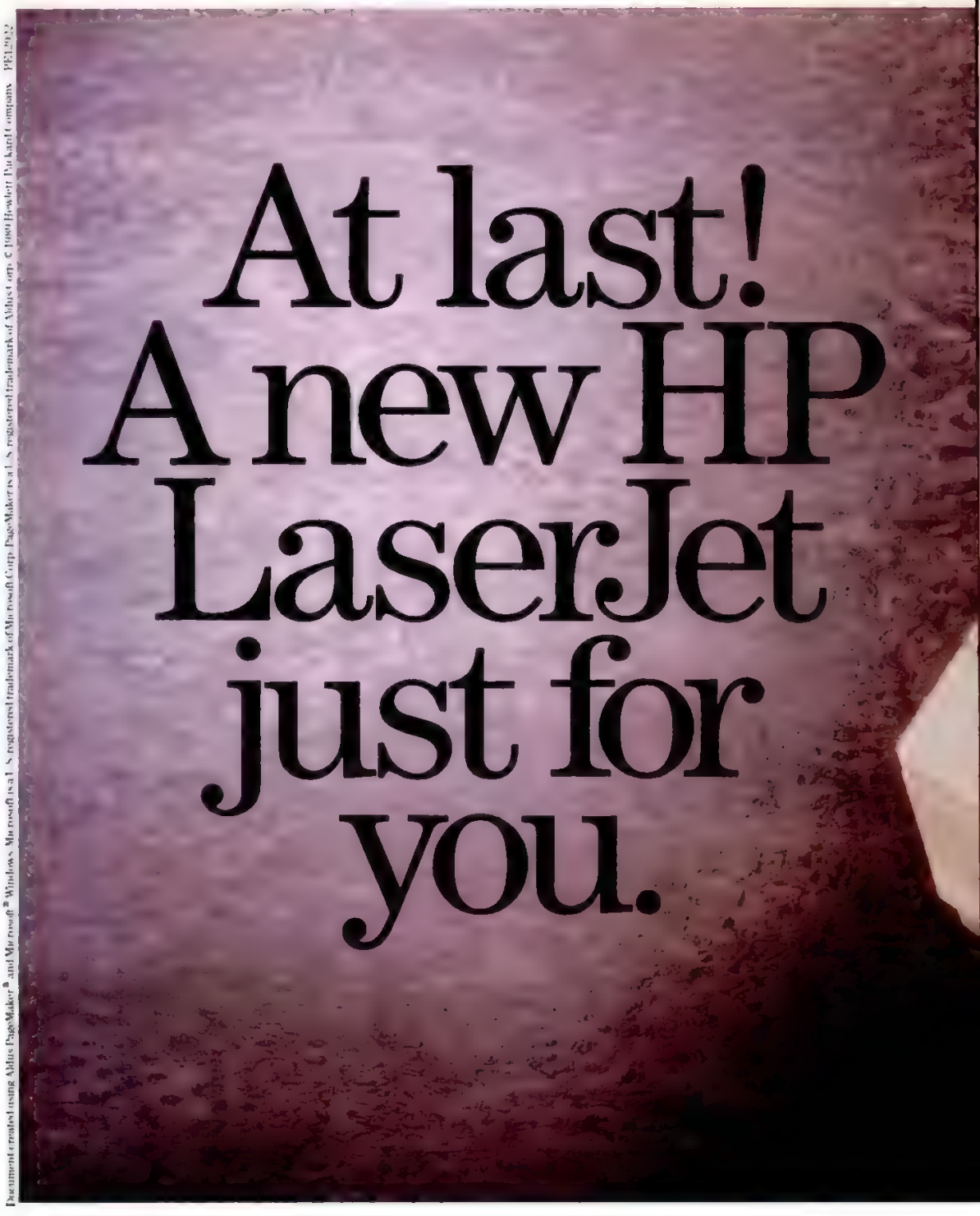
PanaSync™ Multiscanning Color Monitor



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MI PC

CIRCLE 122 ON READER SERVICE CARD



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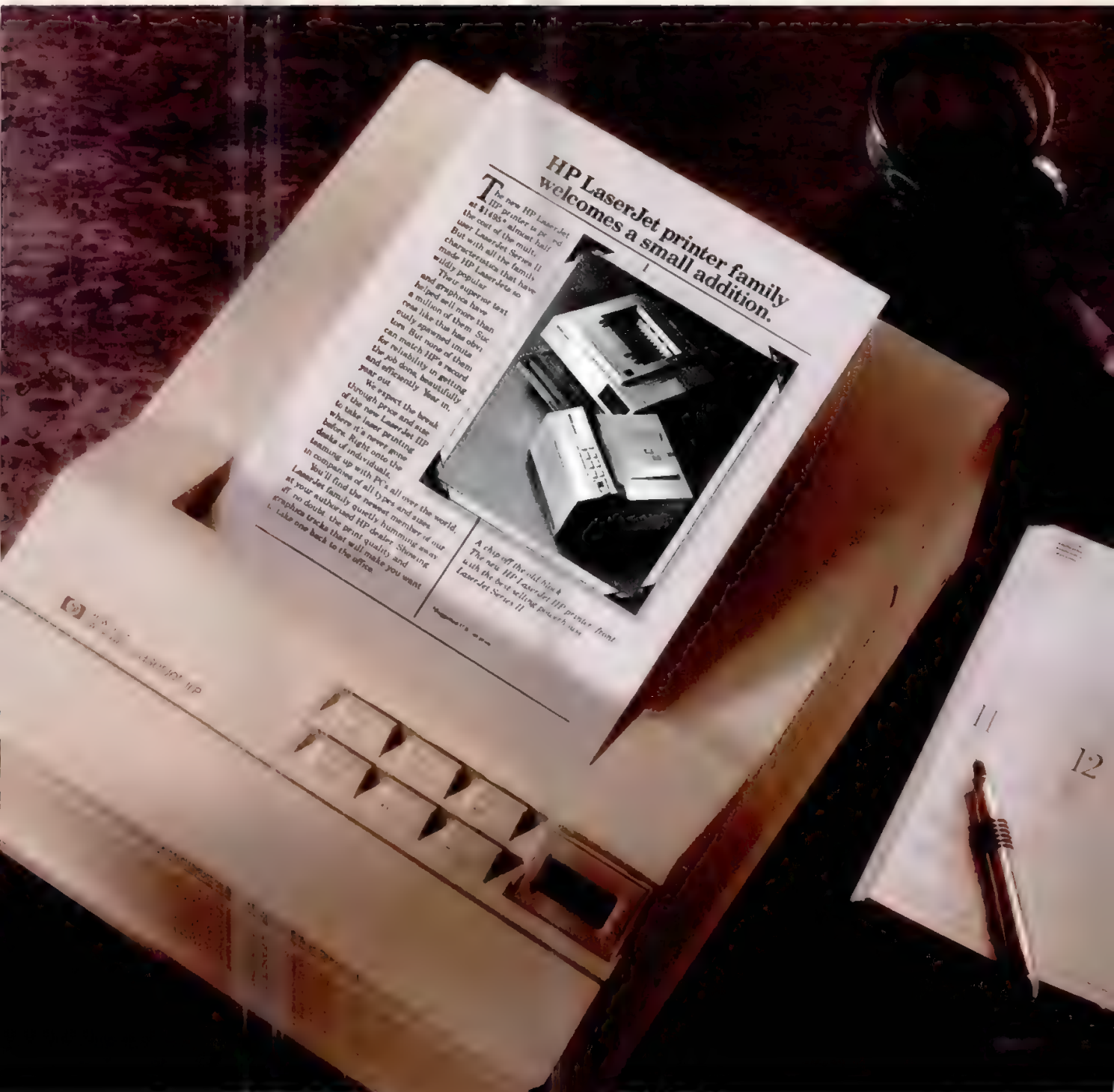
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*Suggested U.S. list prices: LaserJet IIP $1495; LaserJet Series II $2695. Dealer prices vary.



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CIRCLE 305 ON READER SERVICE CARD



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Doing More For The Data Process

CIRCLE 260 ON READER SERVICE CARD

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AutoImport Moves ASCII Text into Spreadsheet and Database Files

HANDS ON

If you often find yourself retyping data from reports into spreadsheets, *AutoImport* offers a better way. This clever $169.95 program can move any ASCII text, whether printed to disk or captured from a terminal session, into a spreadsheet or database file with its data types and column widths intact. Almost all programs can print to disk, and if yours can't, *AutoImport* comes with a memory-resident utility that routes printer output to a file.

With *AutoImport*, instead of specifying the minutiae of the file format, you work directly with an image of the report on the screen, creating a "mask" that defines the columns and lines that you want to include and what type of information (label, value, date, or time) each one will contain. The mask is then used as a template for the translation.

By default, *AutoImport* creates the mask automatically, detecting values, labels, and dates and defining the columns accordingly. It understands such arcana as signed-overpunch numbers and international date and currency formats. But it's easily confused by numbers buried in text items, so you may find it better to turn this option off and to define the columns based on a typical line from the report.

In any case, the program's "painting" technique makes it extremely easy to add, delete, and resequence columns and to define header and title lines until you've masked off exactly what you want to export. Each type of data shows up in a different color; though the program runs in monochrome, a color monitor is really needed to make the most of it.

AutoImport is also more versatile than the text-import functions of your spreadsheet. Reports often suppress repeated values for clarity; *AutoImport* can restore the duplicate values for you. A powerful "line-tag" option lets you append information that appears in titles or subtitles (such as a date of printing) to each record. Utilities let you expand tabs into spaces and unstack multiline reports, and the program's exclude and include options let you zap blank lines and printer-control codes and also do a modest degree of record selection.

Once the mask is defined, running the translation is simple; you can do it from within *AutoImport* or from the command line, which lets you use DOS batch files to automate repetitive jobs, such as downloading a weekly sales report. In addition to creating a file, you can merge the translated output into an existing spreadsheet, from any location, or append it to the end of an existing file.

The program supports a wide range of output formats; among spreadsheets, the formats include those for *Lotus 1-2-3*, Release 1A and 2; *Symphony*; *Quattro*; and *Excel*. *AutoImport* also supports all *dBASE* versions, and the .DIF and SYLK file formats, plus comma-delimited, fixed-field, mail-merge (one field to a line), and tab-delimited ASCII files (the last designed for use with some Macintosh applications but also very handy for exporting tables to your word processor). It even writes random-access files for use with custom programs.

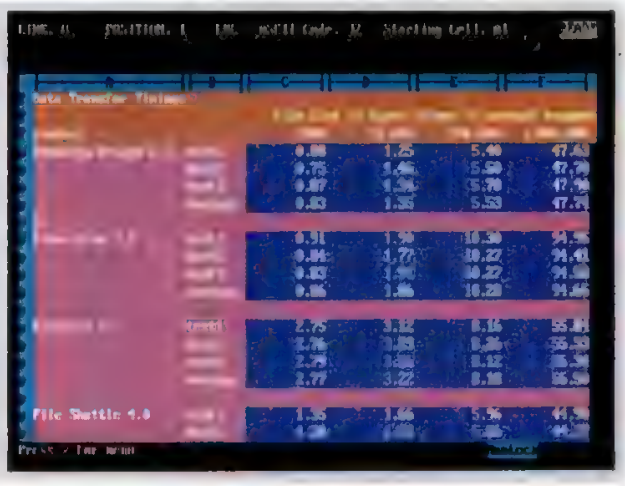
AutoImport includes utilities to translate comma-delimited and *dBASE* files into fixed-field ASCII files that can be used in masks and to break up large files (the program is limited to 1,024 characters per record and to 16,384 records per file). But minor design oversights prevent it from handling these tasks with the ease of spreadsheet conversions.

For example, though you can ignore a string, you can't convert it to nulls or anything else; thus you are prevented from translating invalid data formats. And *AutoImport*'s mailing-label format could be useful for mail-merge except that it doesn't let you define the file and record separators.

AutoImport's user interface, though basically sound (it uses *Lotus*-like menus and commands), is noticeably rough around the edges, starting with the cheesy little advertisements that pop up after each conversion to tell you how much time you've saved over rekeying. In addition, the program is a bit sluggish on screen updates and scrolling, operator error handling is weak, and the help system is a mere list of function-key shortcuts that duplicate the menu items. And for a utility program, *AutoImport* eats up an enormous amount of memory; mask definition takes a full 442K of free RAM.

The sheer variety of its options can also be a bit daunting. Though you can find your way through most conversion problems by consulting the manual, a cookbook approach would be an improvement. And given the program's point-and-act orientation, mouse support would be an asset.

Still, all good ideas take time to come to fruition, and *AutoImport* is no exception. It is so much easier to use than the alternatives, such as *1-2-3*'s import functions, that you can easily forgive its minor crudities. If you have the need for what it can do, *AutoImport* is enormously useful. ■



AutoImport lets you mask the data that you want to export and omit the rest. Each data type is shown in a different color for clarity.

FACT FILE

AutoImport
White Crane Systems Inc., 6400 Atlantic Blvd., #180, Norcross, GA 30071; (404) 446-0660
List Price: $169.95.
Requires: 512K RAM, DOS 2.0 or later.
In Short: This innovative program makes it easy to move information from ASCII text reports to your spreadsheet or database files. Though a bit homely in its incidentals, *AutoImport* is easy to use, and its options are versatile enough to handle most problems that reports throw your way.

CIRCLE 446 ON READER SERVICE CARD

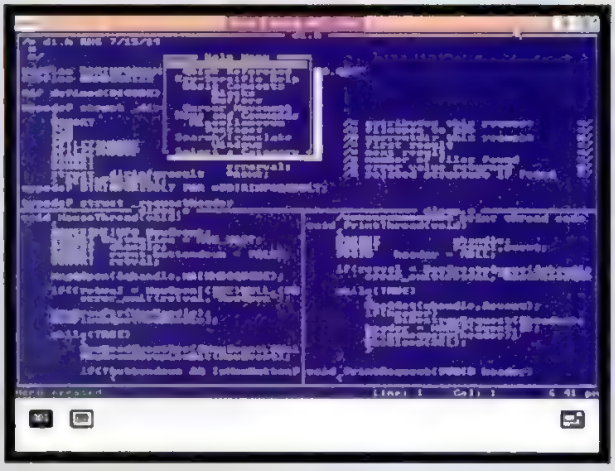
Brief: Programmer's Editor Harnesses OS/2's Virtual Memory Capabilities

HANDS ON
by Richard Hale Shaw

Brief, long considered the most configurable programmer's editor for DOS, is now available for OS/2. The $195 package, which includes a full-screen windowing text editor, context-sensitive help, and a rich macro language, allows you to edit an almost unlimited number of files by taking advantage of OS/2's virtual memory capabilities.

The *r* in *Brief*'s name stands for "reconfigurable," and rightfully so. You can configure almost every part of the program, changing the keystroke assignments and modifying the command set to fit your needs. You can edit and open windows on multiple files or on different parts of the same file at the same time. And since *Brief* is a dedicated program editor, and not a word processor, it's fast.

The program is also safe; it automatically saves your changes to disk during idle time (to protect your work in case of a power outage), and it lets you undo up to 300 previous editing operations (to protect your work from your own mistakes).



Brief for OS/2 is a character-mode OS/2 application that runs well in a PM window. Here it displays C source code for two different files in three different windows.

The subprogram SETUP lets you reconfigure *Brief* whenever you want, modifying cursor size, start-up options, line length, and keyboard repetition speed. You can instruct it to use real tab characters or to fill tabs with spaces. And changing the program's screen colors is a snap: the SETUP program displays a miniature of *Brief*'s editing screen and lets you consider and select color combinations on the spot. The SETUP program creates environment strings that are placed in the OS/2 CONFIG.SYS file, where they will be available to any OS/2 session.

The *Brief* macro language epitomizes the program's reconfigurability. Many of *Brief*'s commands, such as word wrap, are actually macros that you can modify or replace with a few easy steps. The language comes in two flavors: one that looks a lot like Lisp and a newer version that resembles C. You can write individual macros in either, and a converter is provided to translate older macros into the new C-like syntax.

In addition, programming-language macros are included that help you format and modify C, assembler, and other language source files. For example, when you open a new C function with a curly brace, *Brief* will automatically insert the closing brace for you. If you type in a C keyword, such as "if" or "for," *Brief* will add the opening and closing parentheses and position the cursor between them, ready for you to complete the statement.

C programmers perpetually debate code indentation and style and never agree on where to place control braces; yet you can configure *Brief* to indent your code in any fashion or place control braces in any position. The program includes options to format the source code for a half dozen other languages and is flexible enough to handle many others.

Brief includes a powerful and flexible search-and-replace capability that's almost worth the price of the program itself. It uses "regular expression grammar," which is more complex than ordinary search-and-replace syntax. But this allows you to perform more-accurate searches and make some impressive text substitutions.

A character-mode OS/2 application that doesn't use the Presentation Manager's graphical interface, *Brief* can be run in a PM window or in a full-screen session. It uses OS/2's device-independent screen interface, so you can set the number of screen rows from 25 to 128. On a VGA screen, you can display 60 lines of text in a PM window.

Brief takes full advantage of OS/2's virtual memory management capabilities, thus improving its performance when handling multiple files. With several applications loaded, I simultaneously ran numerous copies of *Brief*, each editing over 90 files, and saw no change in the program's speed.

The DOS version of *Brief* limits you to 65,000 lines per file, but *Brief for OS/2* lets you create and manipulate huge files. Under DOS, you can compile programs from inside *Brief*, but you have to pray that enough memory is available and wait for the compiler to finish. With the OS/2 version, there's no "RAM cram," and *Brief* runs the compiler in the background while you simultaneously edit files in the foreground.

One of *Brief*'s most-useful features is its ability to memorize which files are open when you shut down the program. When you start it again, *Brief* reopens the files and places the cursor at the appropriate point in each. You can take further advantage of this ability under OS/2. By creating multiple *Brief* entries in the Start Programs window and specifying a different start-up directory for each, you can use different *Brief* windows to simultaneously edit the source code of various programming projects without mixing them up.

Apart from its not being a PM application, my biggest complaint with *Brief* is that it doesn't support a mouse. But overall, what may be the finest programmer's editor in the marketplace has just gotten better. If you're in the market for a terrific OS/2-based text editor, you can't beat *Brief for OS/2*. ■

FACT FILE

***Brief for OS/2*, Version 2.5**
UnderWare Inc., 321 Columbus Ave., Boston, MA 02116; (800) 343-7308; (617) 267-9743 (in Mass.); (617) 424-1839 (fax).
List Price: $195 (discounts available for *Bnef for DOS* users).
Requires: 256K, OS/2 1.0 or higher (Standard or Extended Edition), hard disk, display adapter.
In Short: A text and program editor that takes liberal advantage of OS/2's virtual memory capabilities and speed. The program, which is highly configurable, includes a modifiable keyboard and command set and a powerful macro language.

CIRCLE 432 ON READER SERVICE CARD

Don't Be Misled!

Consumers are under the mistaken impression that there are only two methods for sharing printers and data. An article about Data Switches in the July 1989 issue of PC Magazine missed an opportunity to dispel this myth and introduce readers to the advantages of a new technology.

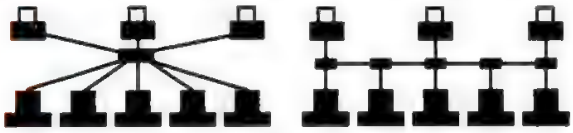
There are actually three distinct printer/data sharing solutions available to the business computer world:

1. Traditional media-sharing LAN's, in all their endless variety, that require software and often special hardware in each computer in order to operate.
2. Mechanical and electronic switchboxes.
3. Universal, external, distributed-processor LAN's.

For some reason our product, the Systemizer Plus—**a universal, external, distributed-processor LAN**—was included in this recent PC Magazine article about data switches. **The Systemizer Plus and the whole Systemizing concept is the complete opposite of a data switch.**

A data switch, by definition, is a single box, with a single processor, and a limited assortment of connections for computers and printers. Using data switch technology for sharing printers and data is analogous to trying to squeeze a sixteen lane tollway through a single toll booth.

Systemizing involves placing a self-contained buffered control unit at each computer, then linking them together to form a network. In keeping with the tollway analogy, Systemizing assigns toll booths to every lane.



Data Switch Systemizing

With an office full of high-speed PC's and laser printers, doesn't it seem likely that the data switch approach would create a bottleneck?

Systemizing offers other advantages too. The term "universal, external, distributed processor LAN" is fitting because Systemizers are:

Universal: A Systemizer control module can attach to almost any kind of computer made, as long as it has a parallel or serial port—a real boon in today's multi-vendor offices. Plus, Systemizing's modularity lets you configure a network to meet any combination of PC's and printers—*and* be able to easily reconfigure at any time—unlike a data switch with its fixed complement of ports. Where personnel and equipment changes are frequent, our universality and flexibility can be a big money saver.

External: The Systemizer control module is external to the computer. No changes or additions to the PC's internal hardware or software are needed. Because each Systemizing module contains its own processor and buffer memory, there's no impact on the computer's memory, disk space and processor—except perhaps for a performance increase.

Distributed Processor: The workload on our LAN is spread over as many as 31 modules. If a module "dies", the rest of the group can continue working. No data switch can offer such performance and security.

PC Magazine missed these rather significant issues and conducted their sole performance test using a *single* computer—for a file transfer! Never mind that sharing printers is of greater relevance to consumers, and let's ignore that they used baud rates possible only with special file-transfer software. Don't you agree that a more realistic test would have involved several computers sending data to printers and to each other?

This isn't the only glaring error or omission in the article. They:

- claimed our price per port was $400 instead of the $200 it actually is.
- understated our number of ports by half and totally overlooked our actual buffer capacity—**we offer 62 I/O ports and 31 megs of buffering.**
- didn't mention that every port can be set for either parallel or serial operation, or that when set for serial operation they're bidirectional.
- misled readers into assuming that our buffer memory must be purchased from us, where in fact you can plug in 64K, 256K and 1 Meg chips of your own. One Editor's Choice charges $925 for a meg expansion; with ours you can achieve a meg for around $140.
- appropriately noted that data switches claiming to run at 115K baud (with 1 user) are actually limited by DOS to 9600 or 19,200 baud for printing. However, they failed to mention that **we've overcome this limitation and offer you the ability to print at four times DOS' 9600 baud rate.**
- failed to point out that our product is the only one that does not require any software in the computer to operate. Nowadays there's barely enough RAM for application programs much less useful TSR's and drivers. Why would anyone want a product that requires a memory resident program in order to function?

Consider this comparison chart of features that consumers are interested in, but were ignored or misstated in the article:

	Systemizing	Editor's Choice "D"	Editor's Choice "N"
Price per port	$200	$215	$160
1 meg buffer upgrade cost	$140	$925	$500
Fastest printing speed	38,400	19,200	19,200
PC RAM used	NONE	70K	70K
E-Mail ability?	Included free	NONE	NONE
Print-job control	Pause, reprint, abort at each user	NONE	NONE

"Price per port" can be misleading, so using the article as a guide I priced a 16 user system for sharing 3 printers.

Editor's Choice "D" would actually cost $10,870 to handle this configuration *and* yield the features that PC Magazine found to gush about. All 16 users would have to vie for the attention of a single processor and only 4 megs of buffer.

Choice "N" would cost $7,935 to handle this configuration, again with all the extras needed. Users would still be squeezed through a single processor and only 1 meg of buffer.

With either data switch you would be forced to use serial connections instead of faster (and more desirable) parallel links between your PC's and the switch. Note also that in this example I do not include the costly cabling required by data switches.

On the other hand, a 16 user Systemizer Plus network would have a suggested retail price of only $8,624, and would yield 16 processors, 16 megabytes of buffering, high-speed parallel connections to each computer, easy user-control at each workstation, E-Mail, low cost cabling and a host of other advantages.

Given the facts, what do you think about the editor's choice?

If you want a LAN without the attendant costs, complications, and expertise required, consider Systemizing. Or if you're thinking about using a data switch, fully investigate our universal external LAN first. Please don't make an important business decision without a thorough personal investigation. I know there's a lot of jargon and hyperbole to cut through out there, but we're ready to help if you're willing to trust your own judgement. Despite the opinion of one magazine editor, consider that several agencies of the U.S. Government and many of the world's largest corporations have standardized on Systemizing—with some using 5,000+ nodes per site. Could they have all been wrong?

Tim Wilde, President.

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CIRCLE 477 ON READER SERVICE CARD

PlanPerfect 5.0 Provides Alternate User Interfaces

HANDS ON
by Craig Stinson

Topping the list of attractions in *PlanPerfect*, Version 5.0, the latest spreadsheet program from WordPerfect Corp., are two alternative menu trees for the benefit of those uncomfortable with the program's native function-key style. Users now can press Slash and issue *Lotus 1-2-3*–like commands or press Esc and navigate through a set of cascading pull-down menus.

All of which is good, since *PlanPerfect*'s native command set mimics that of *WordPerfect*, perhaps the most standard-defying user interface in the industry. This movement toward becoming more compatible with the rest of the software world should be particularly welcome to those many users who write with *WordPerfect* and crunch numbers with *1-2-3*.

Sad to say, the outreach effort fails in many ways. Just having a *Lotus*-style menu doesn't get the job done. At the least, *PlanPerfect* also needs to provide an optional set of *Lotus*-style prompts (as *Quattro* does), alternative function-key assignments, and alternative navigational keystrokes.

Given *PlanPerfect*'s current prompts, the *Lotus* émigré will trip up in many places, such as when saving to an existing file. As for navigation, not even a complete remapping of the keyboard will eliminate certain fundamental problems, such as the fact that *PlanPerfect* varies its response to the Home key according to the number of times in a row you press it.

The program comes with a built-in alternate keyboard map that ostensibly aids the *Lotus*-minded newcomer. Amazingly, though, it does little more than move Help to F1 and restore some of the customary functionality of the Esc key.

On top of this, the *1-2-3* import/export routines are full of bugs. Many functions are not translated on export to *1-2-3* (even though they have equivalents in *1-2-3*), and many simple *1-2-3* macros are not properly converted on import. A WordPerfect spokesperson said the development team is aware of the translation problems and is working to remove them.

PlanPerfect is unusually good at text manipulation. You can assign fonts and other attributes to individual characters in worksheet labels, and for especially long labels you can open an "edit window," a block that behaves like a miniature *WordPerfect* document. The new version supports up to 32 fonts per worksheet, includes all the current *WordPerfect* printer drivers, and comes with zoomable print preview. Other strengths include minimal recalc, a full macro language, and EMS and coprocessor support.

PlanPerfect is a respectable spreadsheet with some uncommon features for those who are comfortable with pressing F3 for help and F7 to quit. But all in all, this new version comes up short in its attempt to appeal to a wider audience. ■

List Price: *PlanPerfect*, Version 5.0, $495; upgrade, $75. **Requires:** 384K (512K recommended), hard disk, DOS 2.0 or later. WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; (801) 225-5000.

CIRCLE 444 ON READER SERVICE CARD

hDC Windows Manager: Not Just Another Pretty Icon Maker

HANDS ON
by Lori Grunin

Before you mumble "another *Windows* shell," consider that hDC Computer Corp.'s $79.95 add-in for *Microsoft Windows, hDC Windows Manager*, doesn't unleash an army of cutesy little icons on your display. Nor does it let you perform complex file-management tasks by clicking a mouse button.

Rather than borrowing icons from the Macintosh, *Windows Manager* borrows the concept of Desk Accessories—a set of utilities and minor applications (called MicroApps) that can be accessed from the Control Panel, and therefore from any *Windows* application.

Although hDC hopes that a host of third-party MicroApps will soon appear, the company provides seven of its own with *Windows Manager*. The most interesting, Work Sets, lets you define groups of applications that open simultaneously when you click a button or press a combination of keystrokes.

The dynamic Memory Viewer is a small but utterly indispensable utility; it displays either a bar- or pie-chart breakdown of occupied memory, including extended memory under *Windows/386*. When shrunk down to an icon, the Memory Viewer continues to display the changing memory values. Similarly, the Font Viewer shows all available screen and printer fonts.

To improve the aesthetics of your *Windows* environment, you can use the Desktop utilities to replace *Windows*' cyan background with a patterned or differently colored one. Desktop accessories include a timed screensaver and a start-up bitmap that you can import from *Windows Paint*. The System Enhancer lets you configure the default windows to tile, overlap, or minimize, as well as determine when they close. Rounding out the set of MicroApps is an unremarkable three-alarm clock.

You control which applications appear on the Control Panel and install any new MicroApps through *Windows Manager*'s Control Menu, whose interface brings to mind the Mac's Font/DA Mover.

hDC Windows Manager is useful, and unobtrusive; best of all, it doesn't require you to reinstall *Windows*. It won't turn *Windows* into the GUI it claims to be, nor will it supply the file-management utilities DOS forgot. But if you're willing to forgo about 10K of memory per MicroApp and a little speed when starting up, *Windows Manager* adds a few amenities to programs that do perform those functions. ■

List Price: *hDC Windows Manager*, $79.95. **Requires:** *Microsoft Windows/286* or */386*, Version 2.0 or later. hDC Computer Corp., 15379 NE 90th St., Redmond, WA 98052; (206) 885-5550.

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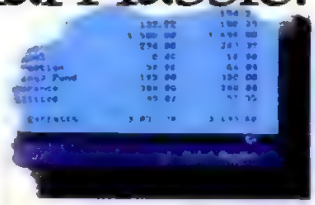


hDC Windows Manager lets you replace *Windows*' cyan background with a patterned or differently colored one.

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Slick! Improves AutoCAD File Management

HANDS ON
by Jeff Prosise

If there's one area where *AutoCAD* falls short, it's in file and drawing management. But CADsystems Unlimited's newly revised *Slick!* (Version 4.0), a versatile drawing manager that lets you manipulate *AutoCAD* files and browse drawings and slides, seeks to change all that.

Slick! is a standalone utility that works with drawing files produced by *AutoCAD*, Version 2.52 or later. With *Slick!* you can forget about *AutoCAD*'s primitive File Utilities menu and perform standard file operations from inside a point-and-shoot shell. In addition, *Slick!* will display *AutoCAD* drawing and slide files just like *AutoCAD*, without forcing you to type in filenames or quit the program to load another drawing.

Slick!'s DOS-shell-like work screen displays a directory tree on the left, a list of .DWG and .SLD files on the right, and a command menu at the bottom. When you find the file you want, a click of the mouse pops it onto the screen for viewing.

Once a drawing is displayed, *Slick!* offers a mouse-driven, *AutoCAD*-like interface, complete with pull-down menus and dialog boxes. You can zoom in by outlining an area of the screen with the mouse or zoom out to show the full image by pressing the right mouse button. You can manipulate blocks and layers individually and alter the viewpoint in 3-D space. If one view isn't enough, *Slick!* lets you divide the screen into as many as four windows. Each can display a different drawing file or a different view of the same file. Should you decide to change a drawing, *Slick!* can launch *AutoCAD* and load a drawing file for editing.

Slick!'s most attractive feature by far is its fast browse option, which lets you use function keys to view successive files grouped together in one subdirectory. And if you need help locating a particular drawing file while you're editing a drawing in *AutoCAD*, you can invoke *Slick!* from within *AutoCAD* by making a minor change to *AutoCAD*'s ACAD.PGP file.

Slick! is available in four different configurations. Level 1 ($95) offers all the basic file-management and -viewing functions and runs on CGA, EGA, VGA, and Hercules video boards. Level 2 ($150) runs on all these, as well as on third-party video adapters supported by *AutoCAD*-compatible ADI device drivers. Level 3 ($195) includes all the features of level 1, plus the ability to plot images on Epson dot matrix and HP LaserJet Series II printers. And Level 4 ($250) combines all the features of levels 1, 2, and 3 into a single integrated package. ■

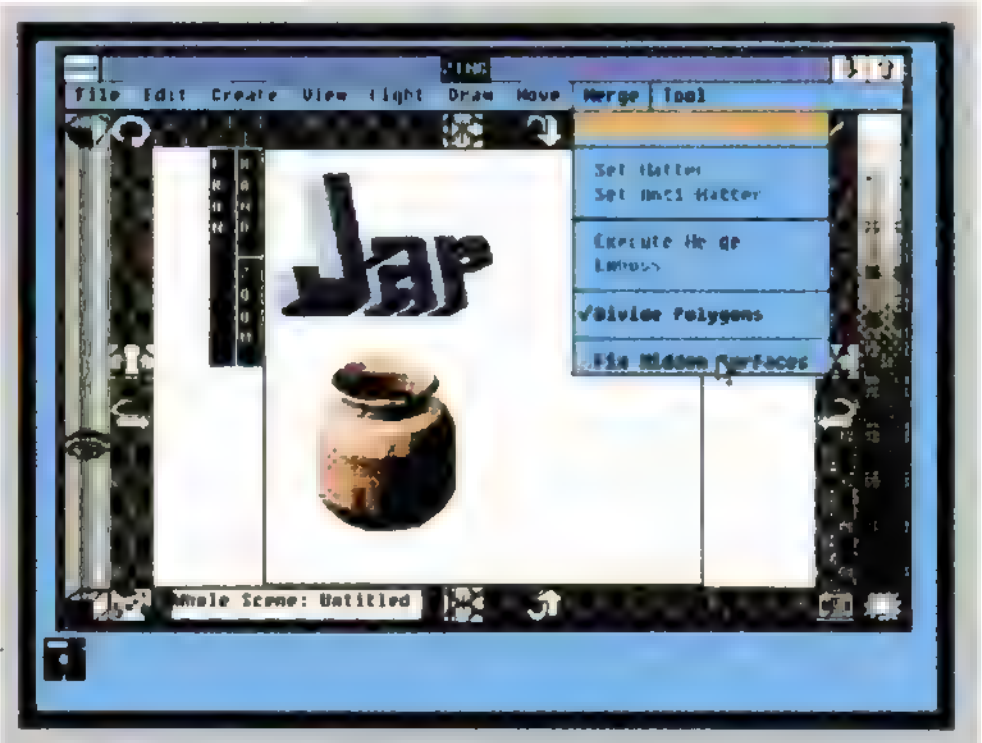
List Price: *Slick!*, Version 4.0, Level 1, $95; Level 2 (includes ADI display support), $150; Level 3 (includes support for Epson and LaserJet II printers), $195; Level 4 (includes ADI display support and support for Epson and LaserJet II printers), $250. **Requires:** 512K RAM, DOS 2.1 or later. 640K RAM, mouse or digitizer, 80x87 math coprocessor recommended. CADsystems Unlimited Inc., 5201 Great America Pkwy., #443, Santa Clara, CA 95054; (408) 562-5762.

CIRCLE 437 ON READER SERVICE CARD

Zing Offers Tools For 3-D Text Creation

HANDS ON
by Luisa Simone

Three dimensions are better than two—that's the theory behind Enabling Technologies' *Zing*, a $199.95 superset of the vendor's *Microsoft Windows*–based solid modeler, *Pro3D*. An incremental improvement rather than a major overhaul, *Zing* offers the same 3-D modeling tools as *Pro3D* and adds new text-handling features for creating 3-D headlines.



The text in this *Zing* screen was typed into a text-entry dialog box. The jar was created using *Zing*'s lathe tool.

Zing's user interface is a model of common sense. Self-explanatory icons border the workspace and let you size, move, light, and rotate objects in space. For example, the level of an iconic eye on a vertical scroll bar indicates the angle of perspective, faithfully mimicking the way you'd move your eye to change your line of sight.

To create an object, you draw and then manipulate its outline—either by extrusion or lathing—in three dimensions. Though *Zing*'s tool kit makes it easy to do this for simple manufactured objects (like jars), it is not powerful enough to render complex, natural objects (like flowers) realistically.

The program's new text-entry screen is by far its finest feature. In addition to the special dialog box that lets you type headlines in text mode, *Zing* comes with a 3-D alphabet. Using the alphabet is as straightforward as selecting the appropriate font subdirectory and waiting while the program retrieves each individual letter file, calculates the correct letter space, and arranges the words on a baseline. And once you've increased the dramatic effect of your 3-D headline, you can export it to desktop publishing programs that support TIFF, .EPS, .EPS with TIFF, .PCX, *Windows* Metafile, and .PIC file formats.

The program also works with Enabling Technologies' eight-volume clip-art series, *Clip3D Library*. The vendor effectively cuts *Zing*'s list price in half by shipping one volume to registered *Zing* users. Given *Zing*'s strong text handling, for most users the best choice among these volumes will be the font collection.

Enabling Technologies' next version of *Zing* will render objects more realistically, either by working with high-end products or by incorporating better surface descriptions directly into its own code. Until then, *Zing* will be of limited value to designers whose needs go beyond 3-D text creation. ■

List Price: *Zing*, including runtime version of *Microsoft Windows* on 3.5-inch floppy disks, $199.95; runtime version of *Windows* on 5.25-inch floppy disks, $15. **Requires:** 640K RAM, *Microsoft Windows* 1.03 or later, hard disk, mouse, graphics adapter, DOS 2.0 or later. Enabling Technologies Inc., 600 S. Dearborn, #1304, Chicago, IL 60605; (800) 544-0629, (312) 427-0408.

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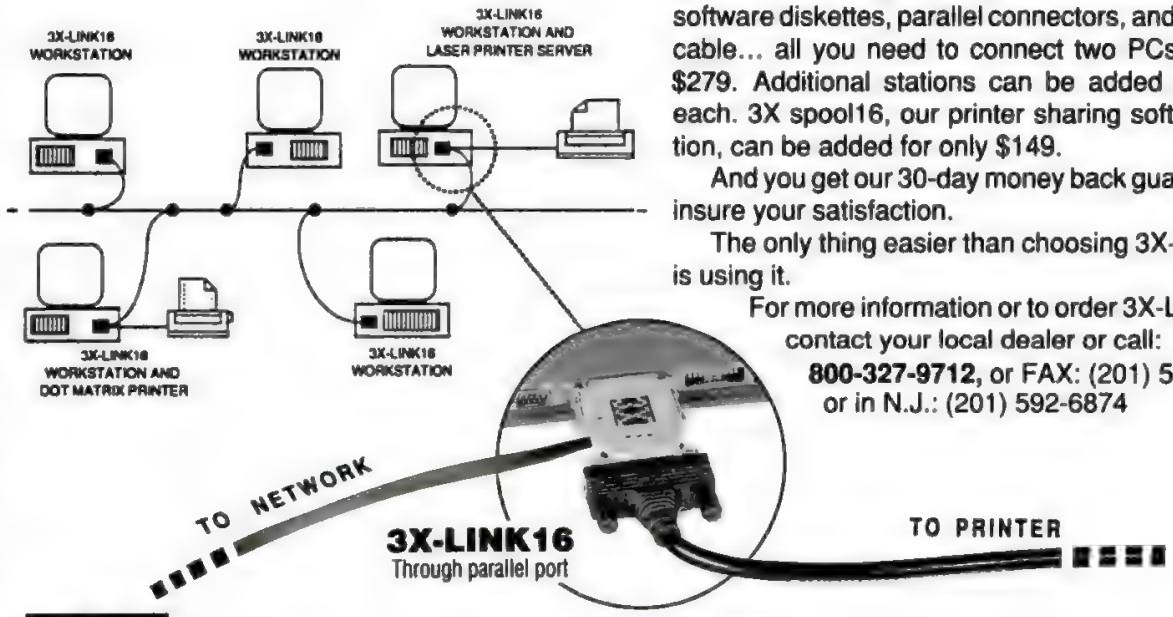


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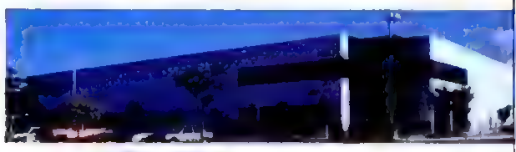
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CIRCLE 163 ON READER SERVICE CARD

Two Communications Programs for Windows Broaden the Field

HANDS ON
By Dany Zandt

Although you might not think of *Microsoft Windows* as being as strong a platform for communications programs as it is for graphics, the release of several new *Windows*-based communications packages should help change its image. In addition to Digital Communications Associates' introduction of *Crosstalk for Windows*, Future Soft Engineering has upgraded *Dynacomm*, which for a long time was the only full-featured, *Windows*-based communications program available. In addition, HI-Q International has launched *Ape*, a fledgling that's full of promise.

Dynacomm ($295) offers a number of *Windows*-specific features, among them a capture buffer that you can recall with scroll bars and mark with a mouse for copying to a file, a printer, or the *Windows* Clipboard; on-screen buttons that send a string or run a script when you click on them; DDE support for exchanging information with other *Windows* applications; and dialog boxes that you can invoke in scripts and during background transfers.

Three features separate *Dynacomm* from the competition: network support, separate versions for the Macintosh and for synchronous communications from *Windows*, and an editor linked to its script compiler. You can direct *Dynacomm* to communicate via COM1 or COM2 or tell it to connect via ComBIOS or NetBIOS.

The communications aspects of *Dynacomm*'s script language are comparable to those of *Crosstalk for Windows*'s script language. But *Dynacomm*'s script language offers stronger support for creating a customized user interface. You can use it to create dialog boxes, menus that can act as replacements for the standard *Dynacomm* menu, file list boxes, and several icons. While *Dynacomm* supports DDE, it has its own names for all of the functions. *Ape* and *Crosstalk* use standard *Windows* terminology.

If *Dynacomm*'s built-in editor finds a syntactic error when you compile a script, you can then call up the editor, which loads with the cursor at the position of the error.

With VT220 support, *Dynacomm* is stronger than *Crosstalk for Windows* on emulations but weaker on binary transfer protocols. Not only is it missing Zmodem and CISB, but it also doesn't offer options for changing packet size and pacing as *Crosstalk* does. Its most serious omissions are the lack of a phone book and of room in the script-list box for a description of what the scripts do. But overall, *Dynacomm* merits serious attention.

Like *Dynacomm* and *Crosstalk for Windows*, *Ape* offers DDE support and scroll-bar access to a capture buffer. However, the $189 program does not provide on-screen buttons for launching scripts.

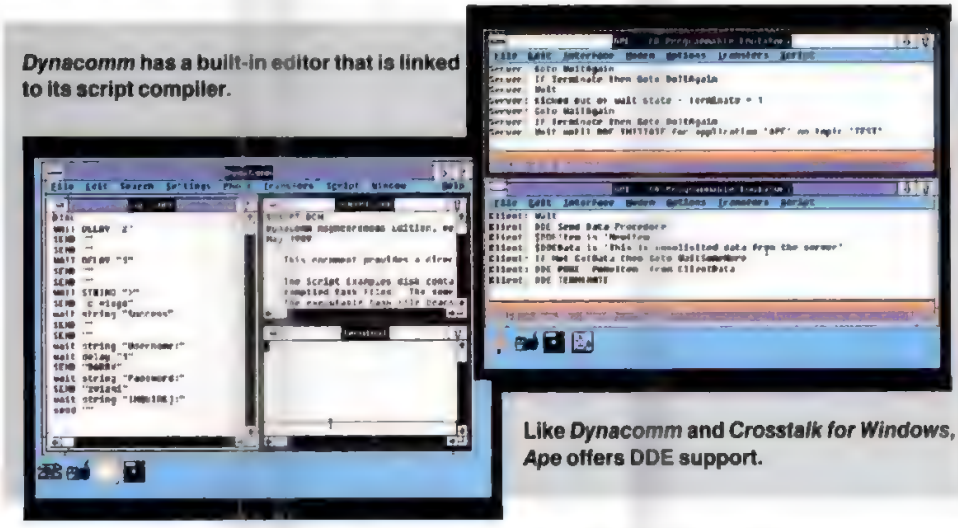
Ape has several features that set it apart from the pack. For one, its chat mode lets you carry on a written conversation with another *Ape* user while a file transfer is taking place in the background. Since the program lets you run more than one script at a time, you could have a script look for a message that had arrived via electronic mail while a second script downloaded data.

You also can call up the command line and enter script commands interactively, a feature that's useful both for debugging and for quick operations. In addition, the program has a broad array of diagnostic tools and keeps a journal file on-disk with information about connections, file transfers, and times.

Ape is still rather rough around the edges. It supports only Xmodem, Ymodem, and Kermit protocols, but CISB is a grayed-out option on the menus, an indication of what's to come. You cannot adjust the time before a dial is cancelled because of no answer except by looking up the command in your modem manual and editing the relevant script. And while the scripts support simple text-input dialog boxes, they don't provide for file-list boxes, radio buttons, check boxes, or user-made menus.

According to HI-Q International, these amenities will be included in future releases. If you purchase the program, it would be advisable to opt for the $65 extended support plan, which provides upgrades for a year.

Ape is a very promising package with some special features and lots of good ideas to build on. In 6 months, it could be the *Windows* communication package of choice. ■



Dynacomm has a built-in editor that is linked to its script compiler.

Like *Dynacomm* and *Crosstalk for Windows*, *Ape* offers DDE support.

FACT FILE

***Ape*, Version 1.02**
HI-Q International, 1142 Pelican Bay Dr., Daytona Beach, FL 32019; (904) 756-[illegible]
List Price: $189
Requires: *Microsoft Windows* 2.0 or later; mouse strongly recomended.
In Short: A fledgling *Microsoft Windows*–based communications program with a handy chat mode. Still rough around the edges.

CIRCLE 450 ON READER SERVICE CARD

***Dynacomm*, Version 2.00**
Future Soft Engineering, 1001 S. Dairy Ashford, #203, Houston, TX 77077; (713) 496-[illegible]
List Price: $295; upgrade from Version 1.x, $50.
Requires: *Microsoft Windows* 2.10 or later; mouse strongly recommended.
In Short: A *Microsoft Windows*–based communications program that offers network support, separate versions for the Macintosh and for synchronous communications, and an editor linked to its script compiler.

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CIRCLE 205 ON READER SERVICE CARD

by Alan Cohen

New&Improved

News of Announced Products and Upgrades

CD Technology's Porta-Drive CD-ROM Travels with You

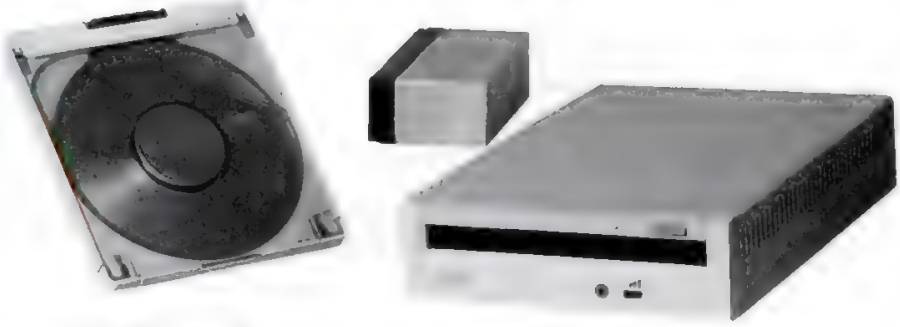
NEW

If something can be made to sit on a desk, it's only a matter of time before someone's going to shrink it and sell it to someone with a laptop. That's what **CD Technology** has done with its $895 Porta-Drive, a Toshiba-manufactured portable CD-ROM drive that can be taken anywhere a portable computer can go.

The drive, which measures 2 by 6 by 9 inches (HWD) and weighs 4 pounds, has a storage capacity of 683MB and an average access time of 350 milliseconds. The $200 DC battery pack features a 4-hour life expectancy on a single charge and a recharge time of 6 hours, according to the company. If you have no other SCSI devices in your machine, then you need the SCSI adapter kit.

List Price: CD Technology Porta-Drive, $895; ISA-bus SCSI adapter, $150; MCA bus adapter, $440. CD Technology Inc., 780 Montague Expwy., #407, San Jose, CA 95131; (408) 432-8698.

CIRCLE 439 ON READER SERVICE CARD



CD Technology's new Porta-Drive is a Toshiba-manufactured CD-ROM drive that adds 4 pounds to your load.

Autodesk Animator Enlivens Your Presentations

NEW

If you're looking for something to take the place of computer-generated slide shows, your search may end with *Autodesk Animator*, a $299 animation and paint program from **Autodesk** that lets you inexpensively create fully animated presentations. You can animate, edit, and produce a completely finished *flic*, or animated sequence of 256-color, 320 by 200 VGA pictures. Flics can be either displayed on the computer or recorded onto videotape.

Autodesk Animator features five different types of professional animation techniques (cel and optical animation, polymorphic tweening, color cycling, and titling); image processing; 22 paint tools, including boxes, polygons, circles, spline curves, ellipses, and stars; cutting and pasting; and a video in/out capability. (Output to VHS requires a VGA card with NTSC output capability or comparable configuration.)

The package also includes a projector/player utility that allows users to distribute presentations, and a set of image-conversion programs to import images in .PCX, .GIF, Atari, Macintosh, Amiga, *AutoCAD*, *Auto-*

CONTINUES ON PAGE 54

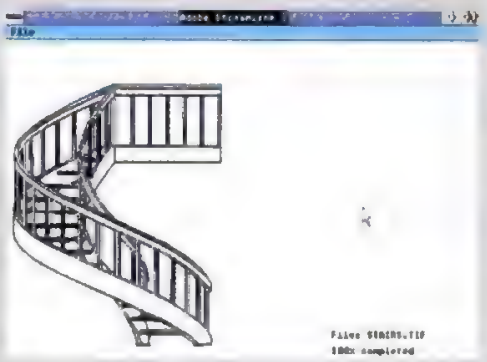
HOT PROSPECT

ADOBE STREAMLINE CONVERTS BITMAPPED IMAGES INTO POSTSCRIPT

One of the advantages of an image in PostScript format over a bitmapped image is flexibility; vector graphics can be cleanly scaled and edited in endless ways. *Adobe Streamline—Windows Version* helps you overcome the difficulties of editing bitmapped graphics by tracing your raster images and converting them into **Adobe** PostScript.

The $395 package features a tracing technology that can detect the edge of a filled-in area as well as the center of a line. *Adobe Streamline* can reverse images, create templates from TIFF files for use in a drawing package, and convert sections of an image rather than the whole image. In addition, you can control how tightly the program follows the bitmap's curves.

Supported input file formats include compressed and uncompressed TIFF, .PCX, and MacPaint files (*Adobe Streamline* will not convert files that contain varying levels of gray, color, continuous tones, or halftones). However, the package can output images in Encapsulated PostScript, *Adobe Illustrator*, and *Micrografx Designer* (Version 2.0) file formats.



***Adobe Streamline* converts bitmapped line art into Encapsulated PostScript, *Adobe Illustrator*, and *Micrografx Designer* file formats.**

List Price: *Adobe Streamline—Windows Version*, $395. **Requires:** 80286- or 80386-based computer; 640K RAM; 20MB hard disk; high-density floppy disk drive; *Microsoft Windows* or *Windows/386*, Version 2.03 or later, or *Windows/286*, Version 2.10 or later; DOS 3.1 or later. Adobe Systems Inc., 1585 Charleston Rd., P.O. Box 7900, Mountain View, CA 94039-7900; (415) 961-4400, (800) 344-8335.

CIRCLE 438 ON READER SERVICE CARD

New & Improved

Autodesk

CONTINUED FROM PAGE 53

Shade, and Targa file formats. Another bonus is that, photographs and images produced by a still-video camera can be loaded into *Animator*, too.

List Price: *Autodesk Animator*, $299.

Requires: 640K RAM, hard disk, VGA display, Microsoft-compatible mouse or SummaSketch tablet, DOS 2.0 or later. Autodesk Inc., 2320 Marinship Way, Sausalito, CA 94965; (800) 525-2763, (415) 332-2344.

CIRCLE 441 ON READER SERVICE CARD



Autodesk Animator **includes a full set of drawing tools, as well as sophisticated controls for the 256-color palette.**

IMPROVED

***Atlas*Graphics*, Version 3.0**—Strategic Locations Planning's enhanced desktop mapping package allows users to assign specific display attributes for types of data values. Improvements allow the user to control the color, size, and type of a point or line on a map according to its underlying data value. Users can assign a symbol to a data point representing the location of a customer, for example, and link the size or color of the point to a database. Version 3.0, which supports VGA, retails for $450. Current *Atlas* users can obtain the update for $100. Strategic Locations Planning Inc., San Jose, Calif.; (408) 985-7400.



***Atlas*Graphics* 3.0 can attach information from a database to specific points on a map, such as the shopping malls shown above.**

***OmniPage*, Version 2.0**—This updated release of Caere Corp.'s page-recognition package is available in two formats: a software-only version for use with 80386-based PCs, and a version for 80286-based machines that includes both software and a coprocessor board. New capabilities incorporated into both versions include recognition of landscape-oriented pages (such as spreadsheets and multicolumn newspaper pages) and European characters (including accent marks, umlauts, and tildes). In addition, a modified user interface is provided, and multiple copies of the same document can be saved in different file formats for use in word processors, spreadsheet programs, databases, or desktop publishing programs. *OmniPage* 2.0 for 80386-based computers retails for $895, while the 80286-based version lists at $1,995. Current *OmniPage* users can upgrade to the new release for $150. Caere Corp., Los Gatos, Calif.; (408) 395-7000.

Battery Watch II—Traveling Software's *Battery Watch* software for laptop computers boasts several new and enhanced features, as well as added support for the GRID 140XT, HP Vectra, and Toshiba T1600. *Battery Watch II*, which works with over 30 laptop models in all, checks the status of the computer's hardware components every 4 seconds. Using this information, the program calculates the current rate of power consumption and the estimated life expectancy of the battery. With many of the newer laptop models, *Battery Watch II* automatically detects if an AC adapter is plugged in or if a modem is on-line. If the program discovers an adapter in use, it calculates the rate of battery charging and displays that information on the pop-up "fuel" gauge. The gauge also displays the status of the modem and a "countdown" to the estimated time the battery will be empty. The package includes an options screen for easy editing of power-consumption values, alarm times, device timeouts, and the hotkey to invoke the *Battery Watch* display. Also new is a deep-discharge function to drain the battery as completely as possible. *Battery Watch II* retails

CONTINUES ON PAGE 56

37-Inch Display Makes Presentations Easier on the Eyes

NEW

If you constantly find yourself sitting in the back of a room squinting at the fuzzy rendering of someone's painstakingly created presentation graphics, you might want to invest in **Mitsubishi**'s 37-inch (35-inch viewable) XC-3715C color display.

The $7,599 monitor supports both analog and digital input from PCs and the Apple Macintosh II, in resolutions of up to 800 by 600, and automatically synchronizes the signal over frequency ranges of 15 to 36 kHz horizontal and 45 to 120 Hz vertical. It also accepts NTSC, Super VHS, PAL, and SECAM input and has stereo inputs and speakers for the accompanying audio signals.

The XC-3715C has a stripe pitch of 0.85 mm. in the center and 1.1 mm. at the corners. Settings can be changed via front-panel controls or the wireless remote. You can put the monitor on the $995 floor-standing base.

List Price: Mitsubishi XC-3715C, $7,599; floor-standing base, $995. Mitsubishi Electronics America Inc., Information Systems Division, 991 Knox St., Torrance, CA 90502; (213) 515-3993.

CIRCLE 443 ON READER SERVICE CARD

Generic Software's CADD Enters the Third Dimension

NEW

Generic Software's first foray into the three-dimensional computer-aided-design and-drafting arena, the $249.95 *Generic 3D Drafting*, builds upon the same graphical user interface and command structure that *Generic CADD* users have become familiar with, add-

CONTINUES ON PAGE 56

BORLAND'S TURBO C PROFESSIONAL 2.0

CORPORATE TOP RATED PCWEEK 1989 SATISFACTION POLL

PC WEEK POLL: C COMPILERS

	Overall Weighted Score	Overall Reliability	Complete of Command Descript.	Overall Perform.	Complete & Organiz. Document.	Document Clarity	Compiling Process Efficiency	Product Support Quality	Value Relative To Cost	Product Support Access.
Turbo C 2.0 (Borland International)	81	87	79	84	77	78	86	72	70	93
C Optimizing Compiler 5.1 (Microsoft Corp.)	76	83	80	81	78	74	76	68	67	70
C++ 1.07 (Zortech Inc.)	66	68	64	71	63	63	69	60	58	76

"Microsoft was No. 1, but they have been unseated by Borland." PC Week, *May 8, 1989*

PC WEEK POLL: SOFTWARE DEBUGGERS

	Overall Weighted Score	Overall Reliability	Effective. Programmer Interface	Document. Clarity	Complete. Command Descript.	Complete. & Organize. Document	Overall Perform.	Integration Within Programming Environment	C Compiler Compatibility	Product Support Quality	Product Support Access	Value Relative To Cost
Turbo Debugger 1.0 (Borland International)	84	89	90	81	81	81	89	85	81	73	72	93
Codeview 2.2 (Microsoft Corp.)	73	80	71	72	74	74	74	74	78	67	64	72

"Borland's Debugger outshines Microsoft's Codeview." PC Week, *May 15, 1989*

It's two winners in one.

Turbo C,* the core of Turbo C Professional, was the outright winner in *PC Week*'s Poll of Corporate Satisfaction on C compilers. Overall, Borland won with 81. Microsoft* placed second.

Turbo Debugger,* also included in Turbo C Professional, was the outright winner in EVERY category in *PC Week*'s Poll Of Corporate Satisfaction on Debuggers. And, once again, we topped the score with 84, overall. Microsoft came in second-best, 11 points behind.

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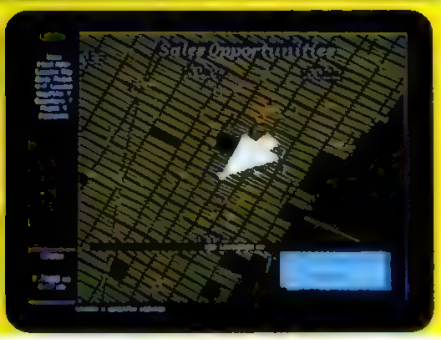
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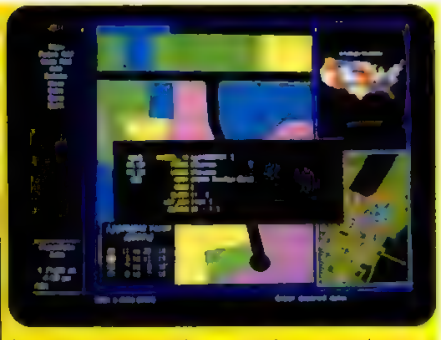
*From Canada, Call (408) 648 4391. Reprinted from PC Week, May 8, 1989; PC Week, May 15, 1989. Copyright ©1989 Ziff Communications Company. Turbo C, Turbo Debugger, and Turbo Assembler are registered trademarks of Borland International. Copyright ©1989 Borland International, Inc. All rights reserved. BI 1328

CIRCLE 377 ON READER SERVICE CARD

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New & Improved

Generic 3D

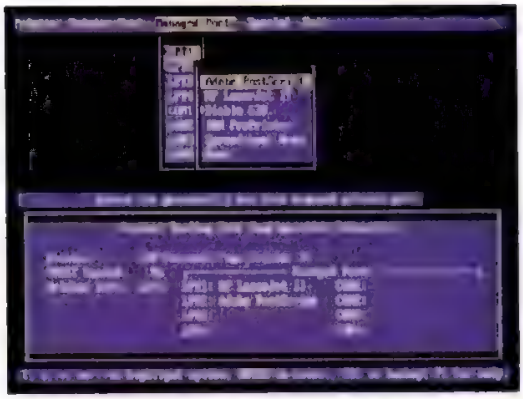
CONTINUED FROM PAGE 54

ing a variety of three-dimensional capabilities. Basic shapes stretch with the cursor as they are drawn, and two-dimensional objects can be created and then manipulated to form a new 3-D object.

A color-coded cursor helps users distinguish between the three dimensions. Rather than typing in coordinates to switch from one plane to another, a feature called *tracking* provides the capability to move along any axis to any given point in space—no matter what the dimension or how deep the point sits—simply by moving the cursor. One program enhancement, is that *Generic 3D Drafting* accepts both absolute and relative coordinate input.

Generic 3D Drafting also includes a full

CONTINUES ON PAGE 59



Generic 3D Drafting uses the same interface as Generic Software's other CADD packages.

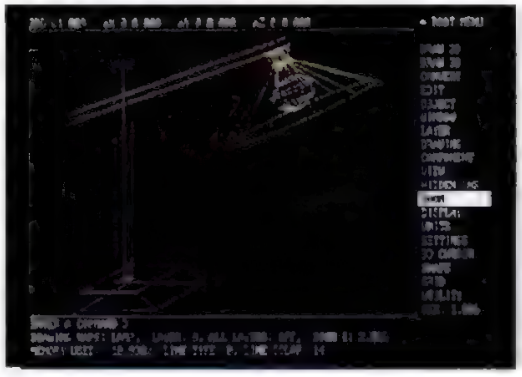
IMPROVED

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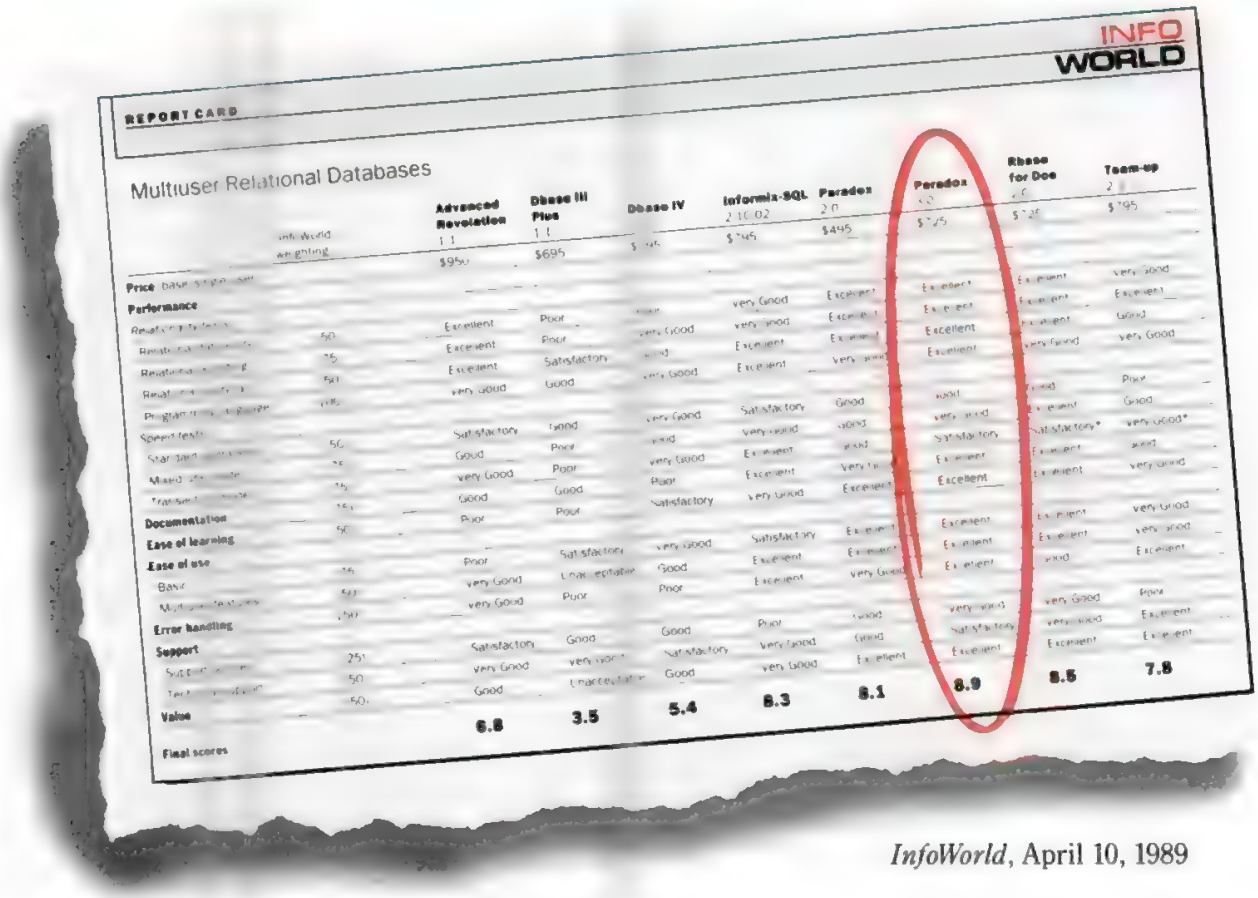
for $49.95. Current registered owners can receive the upgrade for $15.95. Traveling Software Inc., Bothell, Wash.; (206) 483-8088.

***WordStar 5.5 LAN Starter*—**WordStar International has released a local area network version of its *WordStar* 5.5 word processing software. The new package, *WordStar 5.5 LAN Starter,* includes a file server and two workstations. The software, which includes all the features offered in the standard single-user version of *WordStar* 5.5, supports Novell's *Advanced NetWare,* 3Com's *3+Share,* and IBM's *PC LAN.* Enhancements specific to the LAN version include on-screen tutoring, the ability to set up separate configuration files for each user, and file locking, which ensures that only one user can edit a document at one time. *WordStar 5.5 LAN Starter* retails for $595. Additional nodes are available for $150 each. WordStar International Inc., San Rafael, Calif.; (415) 499-1200.

***Trading Post*, Version 2.0—**LaserTools Corp.'s updated release of its PostScript printer utility software supports IBM's Personal Pageprinter II, Model 031. Version 2.0 gives the IBM printer compatibility with non-IBM networks, such as those from Novell, 3Com, Banyan, and Ungermann-Bass, and, according to the company, simplifies control of the Model 031's four built-in software-selectable printer languages. Four different methods to access and control these emulation modes are offered: an emulation can be enabled from a pop-up menu, configured as a virtual LPT printer port, selected through command-line parameters in batch files, or controlled through a menu-driven application program. Furthermore, *Trading Post* 2.0 includes a special Spreadsheet mode, which translates output from non-PostScript software (such as *Lotus 1-2-3*) into PostScript on the fly. Support for all Adobe PostScript printers is also included. *Trading Post,* Version 2.0, retails for $99. Current users should contact the company for upgrade information. LaserTools Corp., Emeryville, Calif.; (415) 420-8777.



***Trading Post* 2.0 lets you select one of four emulation modes for your IBM Personal Pageprinter II.**



InfoWorld, April 10, 1989

The bottom line is 8.9

InfoWorld magazine tested and compared multiuser databases. With a bottom-line score of 8.9, Borland's new Paradox® 3.0 beat the well-knowns and unknowns hands down.

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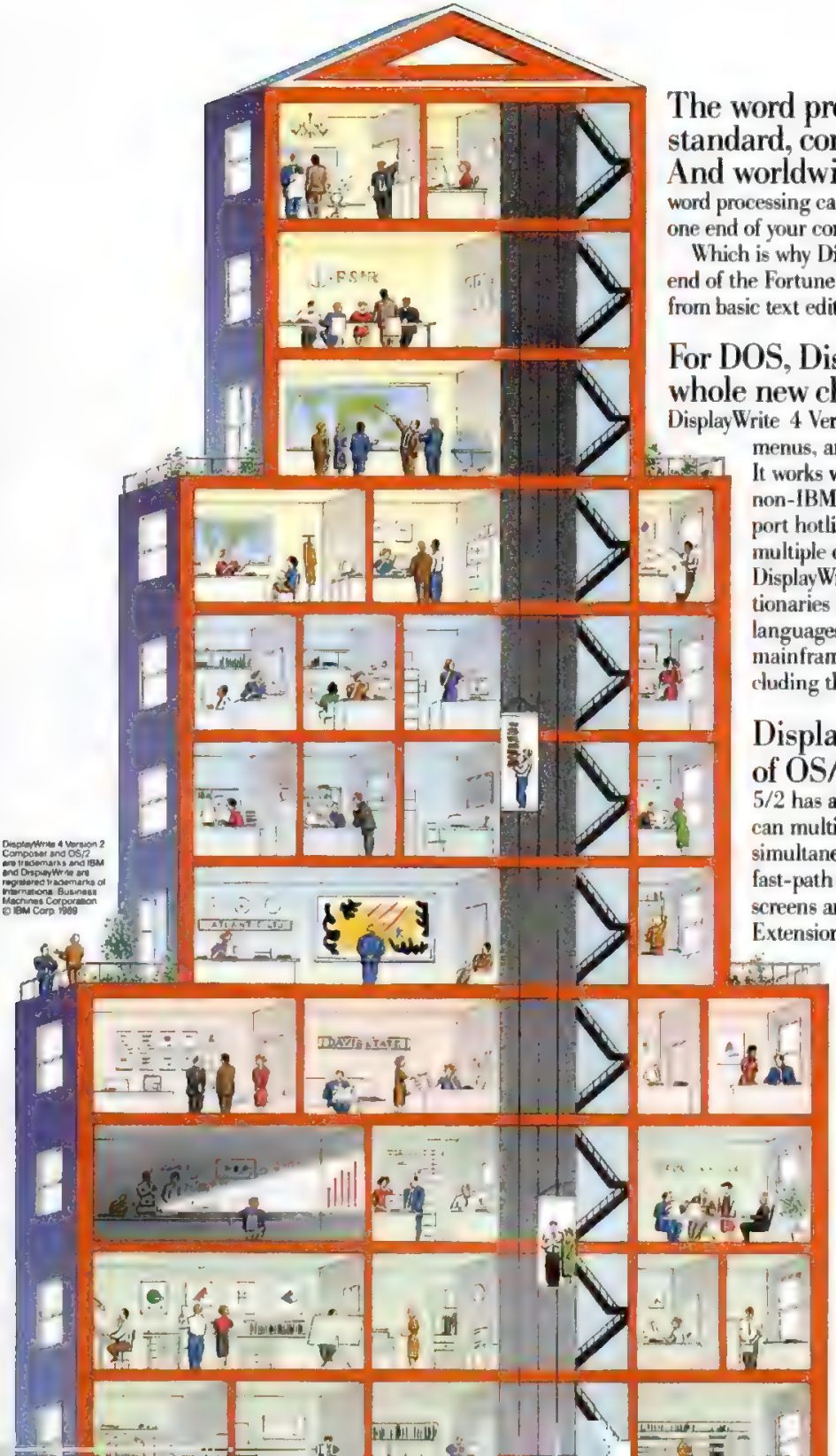
BORLAND

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New & Improved

Generic 3D

CONTINUED FROM PAGE 56

complement of snap commands, unlimited zooms, selectable projections, hidden line removal, a choice of 256 colors, and plotter support. The package is file-compatible with *Generic CADD*, Levels 1, 2, and 3. 3-D drawings can be saved in 2-D drawing format for editing, printing, or plotting in *Generic CADD*.

List Price: *Generic 3D Drafting*, $249.95. **Requires:** 640K RAM, graphics display and adapter with minimum 640 by 200 resolution, DOS 2.1 or later; EMS memory, hard drive, mouse, and math coprocessor recommended. Generic Software, 11911 N. Creek Pkwy. South, Bothell, WA 98011; (800) 228-3601, (206) 487-2233.

CIRCLE 440 ON READER SERVICE CARD

AUTOsight Redlines, Annotates CAD Drawings

NEW

For CAD users who need to solicit comments on their drawings, *AUTOsight*, a new view-only CAD support tool from **deltaCAD**, provides the means not only to display the images, but also to add notes, drawing elements, and colored film to any image. The package's Redline feature allows added information to be saved in an appended .DXF file that does not affect the integrity of the original CAD file.

AUTOsight, a graphics-based menu-driven package that reads .DWG, .DXF, and .PLT files, includes the following additional features: Compare, a tool that conveniently allows users to view only the net differences between two similar but nonidentical drawings; Overlay, which displays a second drawing without clearing the first; and Split Screen, which simply displays two different drawings (or two views of the same drawing) side by side.

The package is capable of panning an image or zooming in on one, and images can also be sent to a printer or plotter. Furthermore, drawings viewed through *AUTOsight* can be saved in a .PCX file, using *AUTOsight*'s screen grabber, for use with programs such as *Ventura Publisher* and *PC Paintbrush*.

List Price: *AUTOsight*, $495. **Requires:** 640K RAM, hard disk, DOS 2.0 or later. deltaCAD Inc., 2003 Cypress Creek Rd., Suite 102-B, Fort Lauderdale, FL 33309; (305) 492-1155.

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A new visio

Accidents happen.

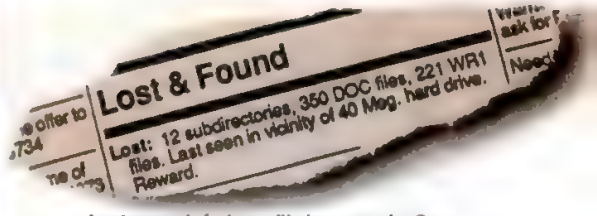
And when they do, nobody makes it easier to recover a deleted file or restore a hard disk than PC Tools Deluxe. But Central Point Software believes a utility product should do more than just protect you from misfortune. More than simply back up your hard disk, recover an inadvertently deleted file, or allow you to manage your files from a DOS shell.

Central Point's vision is that a utility product should enhance your productivity every moment you're at the keyboard. It should simplify the way you find, preview and load a 1-2-3 spreadsheet. Make it easy to combine the contents of one document into another. Even allow you to look up a client's address while you're in the middle of another application. Everyday tasks. Tasks that, without PC Tools Deluxe, are difficult to do and take far too much time.

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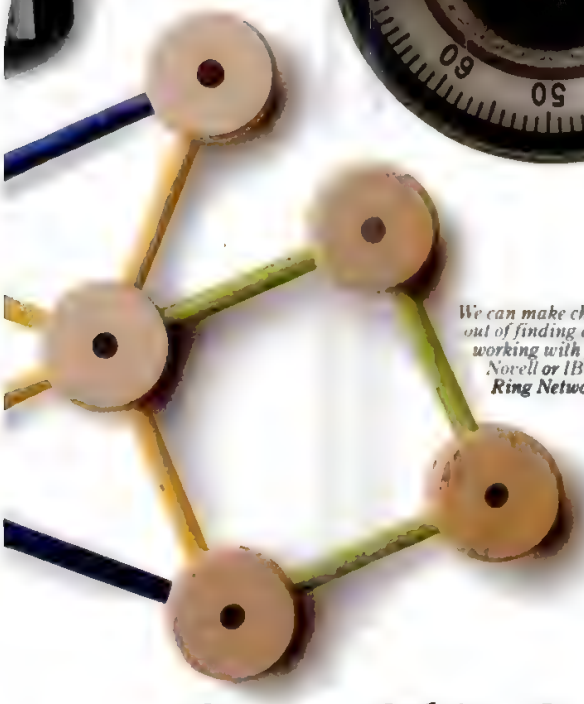
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n of utilities.

dows, full mouse support, pull-down menus and context sensitive help make learning and using the product a breeze. And PC Tools Deluxe conforms to IBM's Systems Application Architecture (or SAA) standards so its look and feel is almost identical to all the other applications you'll see in the 90s.

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Pipeline

A Look at the Trends Shaping the Personal Computer Market

Utility Makers Team Up For the Battles Ahead

The trend toward mergers and acquisitions among PC vendors is about to change the landscape of the bustling utilities market.

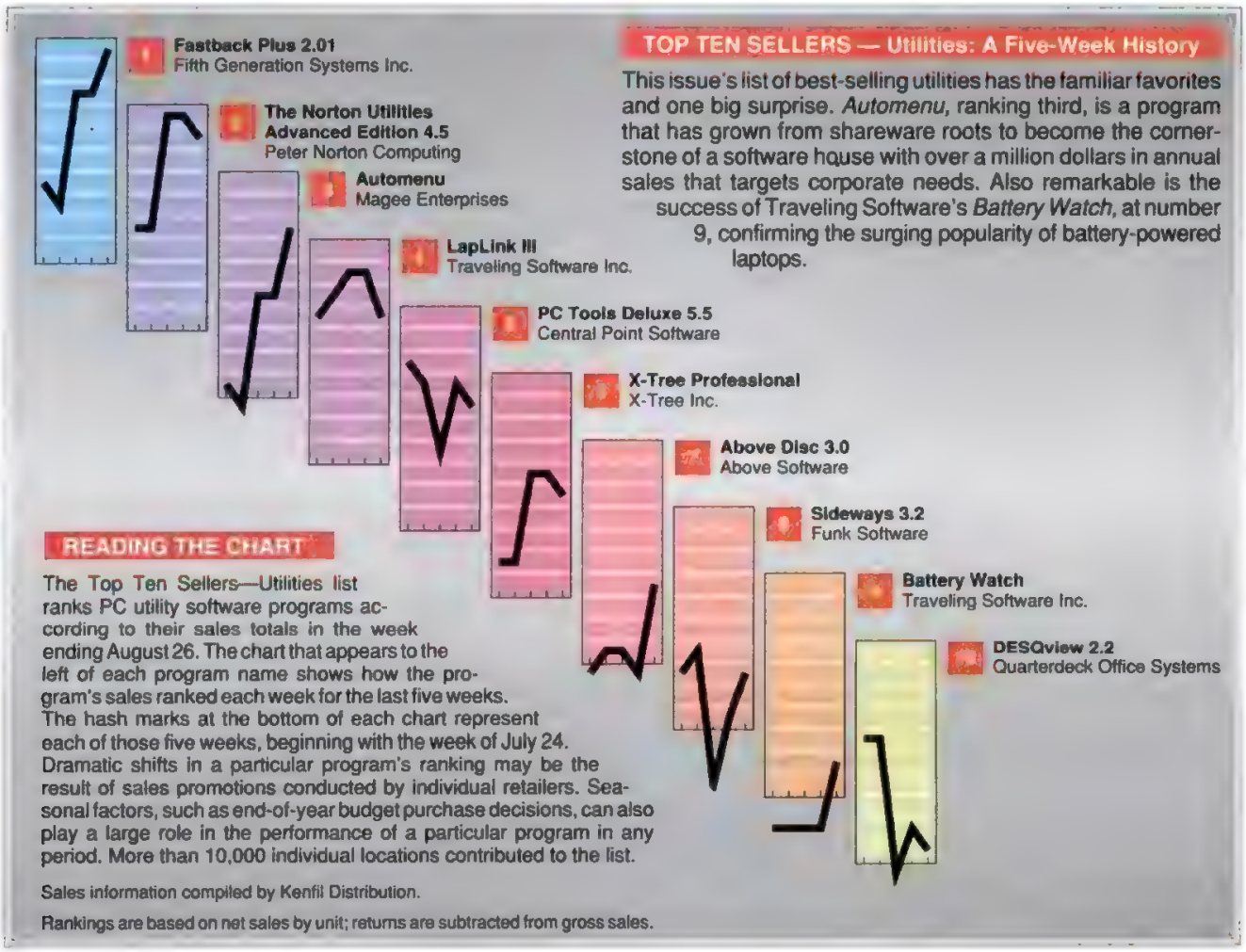
Over the summer, Fifth Generation Systems, flying high with the top-selling backup program *Fastback Plus*, reached over into two other utility categories and acquired the marketing rights to a couple of successful also-rans, *Mace Utilities* and *The Brooklyn Bridge*.

Both packages had been well received critically but were less than overwhelming at the box office. Fifth Generation believes it knows how to make them as popular as *Fastback;* the main ingredient needed is a higher-quality interface.

The company has set out an ambitious growth path for itself that includes a rejection of the one-product-does-it-all approach that has turned both Peter Norton Computing and Central Point Software into powerhouses in the field. Fifth Generation plans to add two new utilities to its selection (for a total of five), building each so that it shares an interface with its family members.

In acquiring the marketing rights to *Mace Utilities* and *The Brooklyn Bridge*, Fifth Generation has retained the passionate involvement of the entrepreneurs who launched the programs and gave them distinct personalities. Paul Mace will continue to lead the development of disk-tuning software that will appear under his name, and Guy Gordon is still coding the upgrades to his file-transfer program. The core programs, however, will

CONTINUES ON PAGE 64



Pipeline

CONTINUED FROM PAGE 63

be dressed and manicured by Fifth Generation's programmers before being put on sale.

The key element in this strategy is a growth plan that builds around people's strengths; the programmers who know how to dig into a disk's file structures can dig away, leaving the menu design to coders who do that best. It also suits the main players' personal preferences. Fifth Generation is firmly rooted in Baton Rouge, Louisiana, and rather than leaving Cajun country to chase programmers in the crowded Silicon Valley, it's building software in a long-distance, contract-based style that contrasts sharply with the centralized, staff-built approach used by Ashton-Tate, Lotus Development Corp., and Microsoft Corp.

Each of the three utilities will be upgraded in October, showing the early fruits of this union. But it won't be until early '90 that the full effect will be seen. In addition to better menu structures, Fifth Generation plans to give managers the ability to take control of some of the more-risky features in these utilities (features like obliterating all traces of a file by nulling all the bytes), so that novice users can be given tailored versions that won't lead them into trouble.

And later next year, a *Microsoft Windows* version of each utility is likely to be available. Making the transition to *Windows* is an investment in programming time that none of the three companies relished making alone; united, however, they feel better equipped to mount new platforms.

ROM Cards Face Uncertain Future

You know there are problems when a committee needs to be formed, and the makers of ultrasmall laptops recently formed a committee to resolve the confused state of affairs surrounding the embryonic ROM card.

> If ROM cards become established, static RAM cards for file storage will follow close behind.

Last fall, NEC Home Electronics (U.S.A.) introduced the NEC UltraLite with the first PC ROM-card port. The company hoped that major software publishers would soon introduce programs on the new medium, but only Lotus and WordPerfect have produced the goods so far.

Meanwhile, Poquet Computer (a start-up) and Atari are poised to introduce ultrasmall portables with ROM-card ports that are not compatible with NEC's standard, creating a dilemma for software publishers who have enough on their plate without supporting new media.

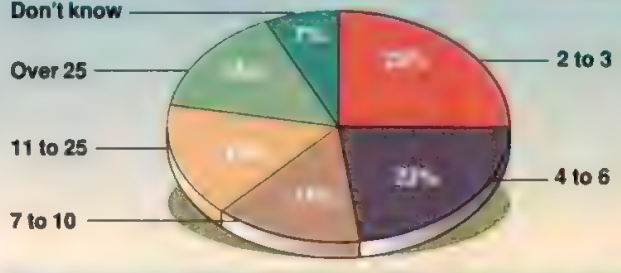
There are two issues. One is the number of connectors (60 or 68). But a more fundamental problem is whether the software should run out of RAM or out of ROM. NEC opted for a RAM approach, attempting to keep the new system close to the DOS environment. Poquet and Atari have designed their systems to run the ROM card–based software out of ROM; this cuts dramatically the amount of RAM needed in the computer, but it also requires that software publishers make significant changes to their programs developed for DOS.

By the way, if ROM cards become established, static RAM cards for file storage will follow close behind. But they won't be giving floppy disks a run for the memory just yet—not until they drop from the expected 1990 cost of a dollar a kilobyte. ■

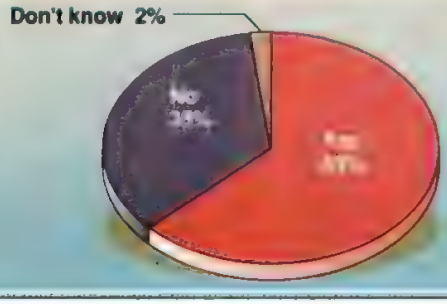
SURVEY

A network isn't the only way to tie PCs together; running terminals out of a 386 PC is one less-expensive approach. We asked callers to PC MagNet with 386 PCs installed at their locations to answer the following questions. The answers demonstrate the growing popularity of—and need for—Unix as the host for DOS applications.

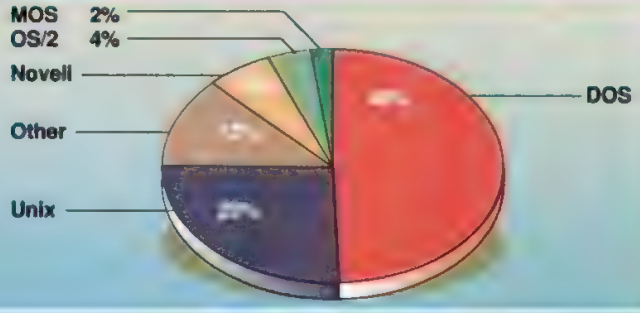
How many users are connected to each 386 PC?



Do you have any 386 PCs operating as part of a multiuser system?



What operating system is used with this multiuser system?



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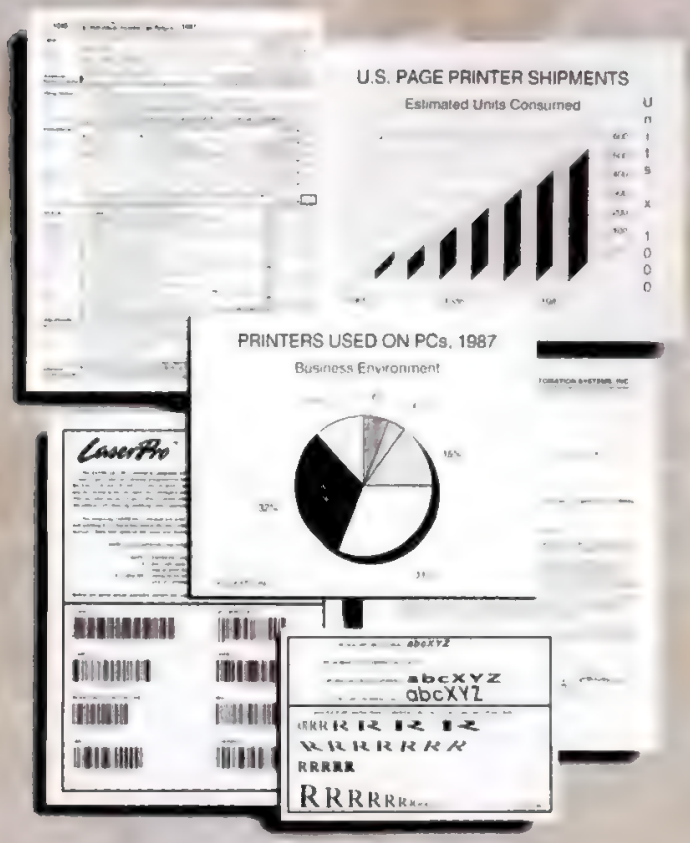
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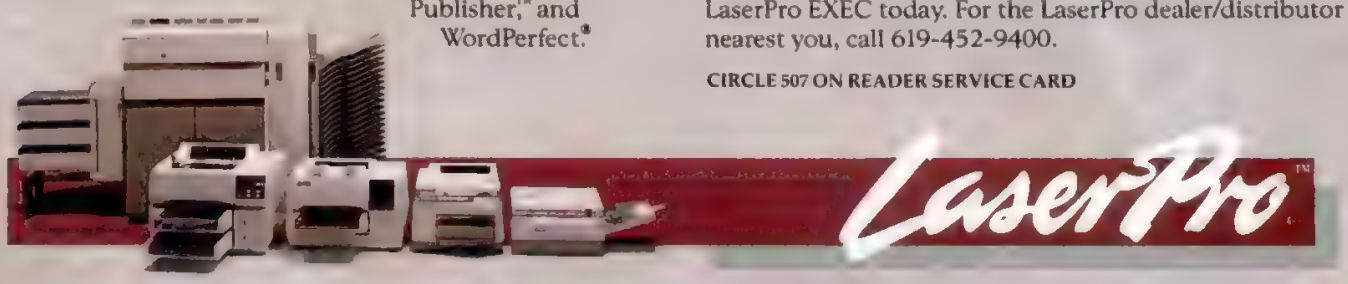


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Bill Machrone



It's all very well to look into the future. But can you get there from here?

Here at *PC Magazine*, we have always prided ourselves on the forward-looking stances we've taken on industry issues, such as our notorious position on the question of 286 versus 386, and our early championing of color and graphical user interfaces. One of the difficulties of being in the vanguard, however, is navigation. It's not all that tough to see the future—in fact, it's usually fairly obvious. The real problem is figuring out how to get there.

For example, no one doubts that CD-ROM will play a major role in the areas of data distribution, reference works, and multimedia software. But almost no one can agree on how it'll all come together. The hardware folks are trying their darndest to drive down the price, but with today's technology, lower prices mean lower performance. On the other hand, since CD-ROM readers are still rare, people aren't likely to miss what they never had.

Things are more uncertain on the software side. The big attraction of CD-ROM, after all, is its enormous capacity. The applications that are out there now, such as Lotus's *One Source* (a compendium of financial and demographic data) and our own *Computer Library* (the full text of *PC Magazine*, our sister publications, and indexed extracts and full text from 120 others) are naturals for the medium. They're also ugly. All of that text is unleavened by photos, illustrations, charts, or captions.

Everyone agrees that the standard computer screen is a poor, almost laughable substitute for the printed page. Those of us in the publishing business, however, are always looking to increase our bandwidth. A magazine is a magnificent random access device, and someday the personal computer will be one too.

Apple's *HyperCard* for the Macintosh is a prime example of how some good basic tools can enable a publishing revolution. Today, a quarter of a million *HyperCard* stacks are shining testimony to the power of the metaphor. The good news is that several *HyperCard*-like products are arriving on the PC, complete with sound, animation, and authoring tools. These programs, along with Super VGA graphics and increasingly prevalent graphical user interfaces, will be the gateway to wider CD-ROM use.

Even a standard VGA shows fairly realistic photographic images in 320 by 200 resolution with 256 colors. When you boost it to 640 by 480 by 256 colors or even 800 by 600 by 256, it's better than high-definition TV. And of course, we'll need the density of CD-ROMs to store those photorealistic images.

EXPANDING POSSIBILITIES

I'm looking forward to using this technology in future *PC Magazine* CD-ROM publications. Imagine being able to access all of our reviews, and to see the information in any order you want. Imagine clicking on a set of results from our benchmark testing, and getting a dialog box that lets you read the review of each machine, look at its photo, and review its features table. We could even include manufacturers' literature and a list of dealers.

Or imagine a CD-ROM disk with all of the *PC Magazine* utilities: source code, executable code, full text of the articles that introduced them, examples of use, even interviews with the authors as they explain their programming techniques and decisions.

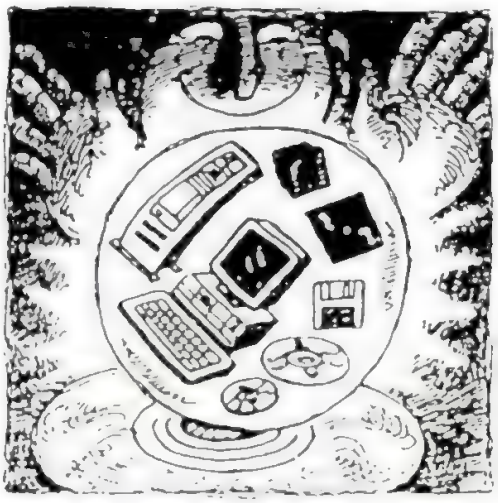
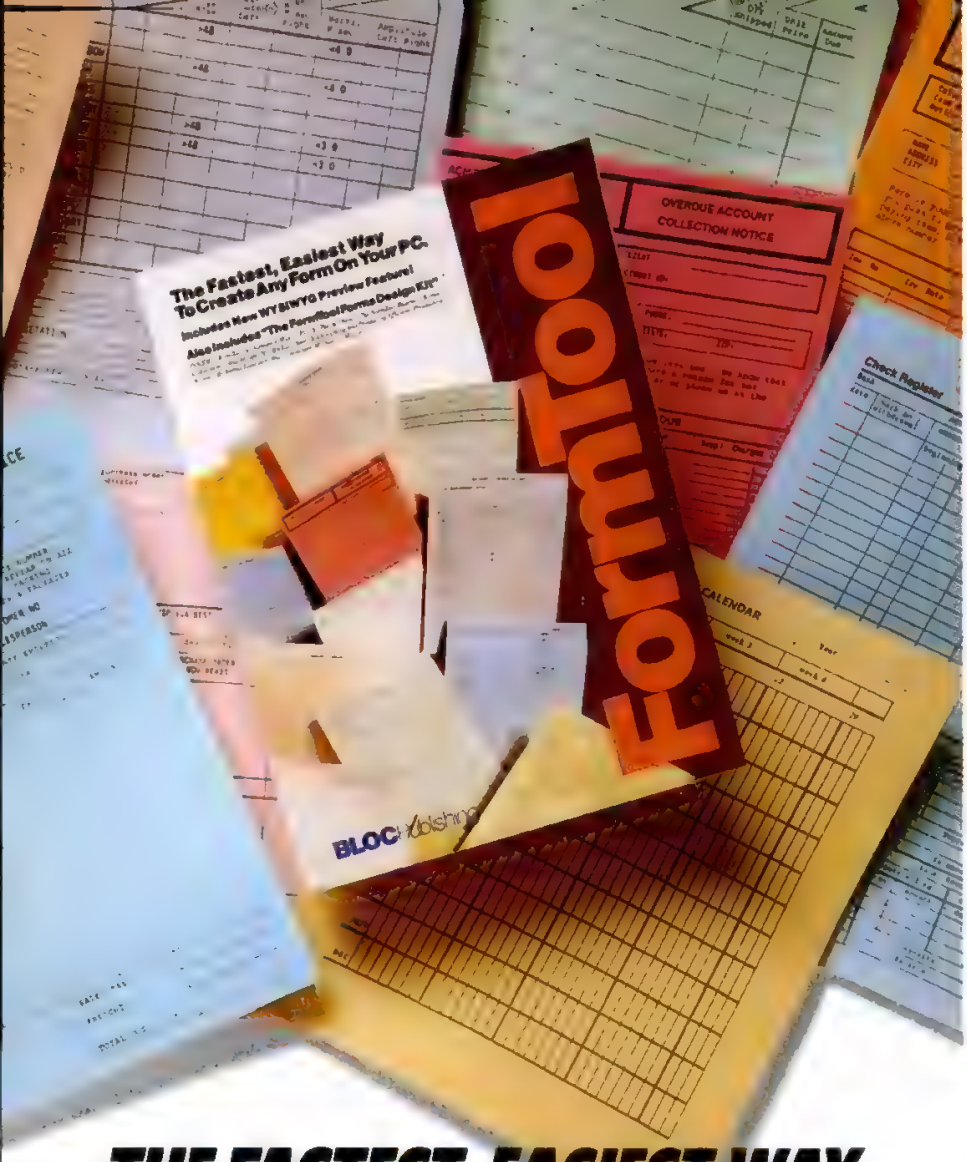


ILLUSTRATION: PETER BONO

That's right: sound will play an important part in future CD-ROM titles. So will full-motion video. Intel has acquired the original RCA digital video team from General Electric and is currently fostering the development of new algorithms and chips that can handle the awesome compression and decompression



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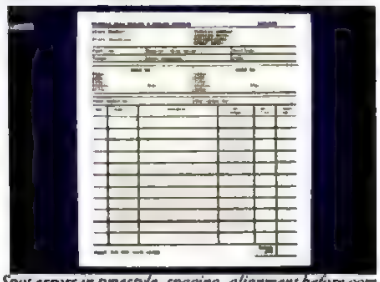
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Bill Machrone

needed for full-motion video in real time.

Meanwhile, Sony is hard at work on what it calls the XA standard for encoding high-fidelity sound on CD-ROMs. In a year or two, this will culminate in software of incredible richness and flexibility. I've heard it called "plasticware," and I've heard it's going to take a cross between Bill Gates and Cecil B. DeMille to produce it well.

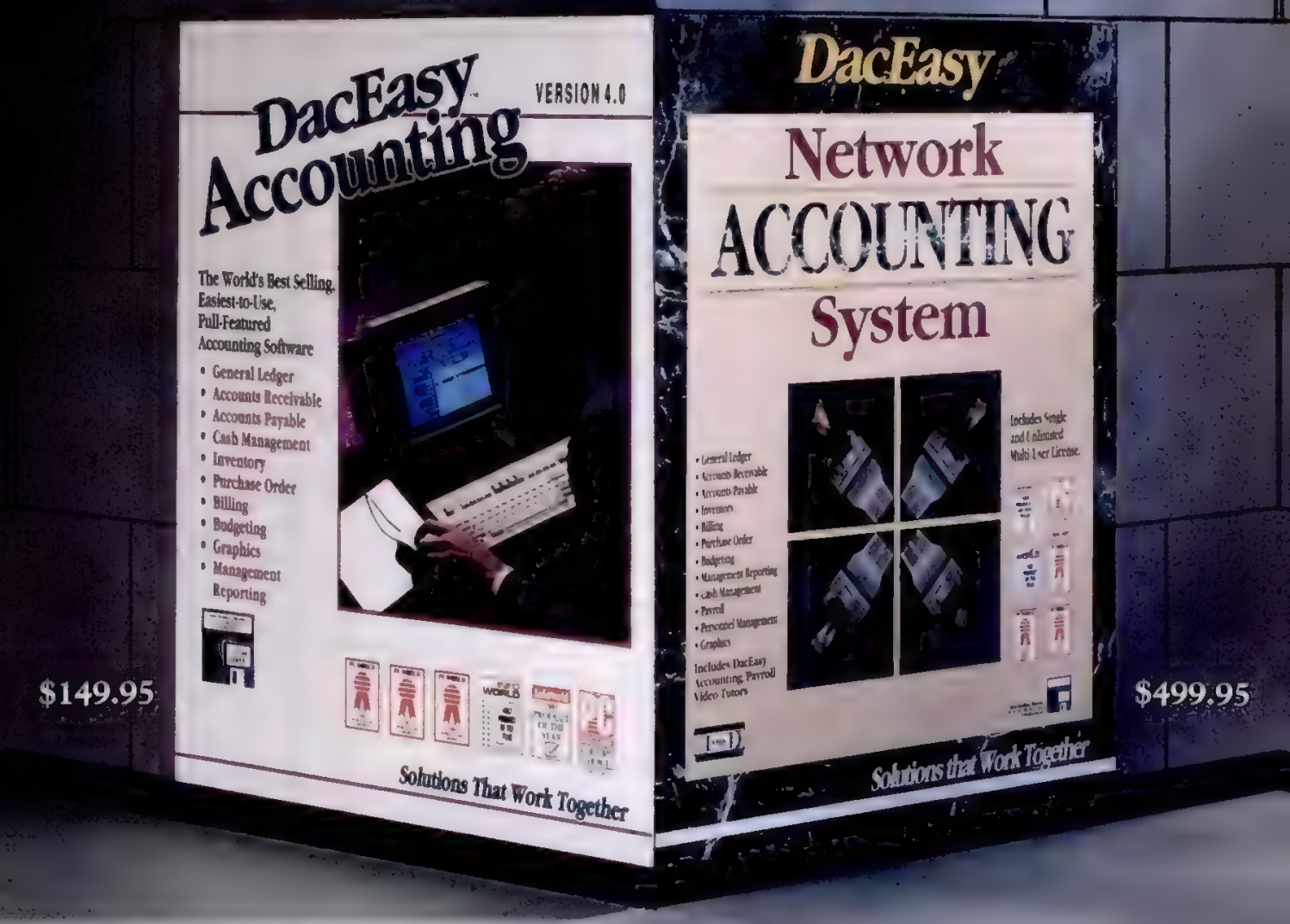
The future is lovely. But suppose you wanted to go into the CD-ROM publishing business right now. What would your choices be? Pretty limited, it turns out. There's no standard way to scan in color images and no standard resolution. Most of the retrieval software is oriented toward text only. Indexing techniques tend toward the brute-force side of things.

There are a few products, such as Owl Software's *Guide*, that help you to build hyperdocuments. Most run under *Microsoft Windows*, because a pointing device is a key ingredient in hypertext, and because *Windows* makes the programs independent of devices and resolutions. Unfortunately, none of them has the speed of *Tornado*'s Get command or the sophistication of *Magellan*'s indexing and fuzzy searching capabilities. Of course, 500MB is more of a challenge to handle than a bunch of notes in RAM, but the techniques are clearly available.

Along the way, we'll stumble over the definitions of multimedia and hyperdocuments. Factions will form. Products will subspecialize. The computer-based-training minions will have their favorites, heavy on the easily explored hyperdocument. The presentation graphics crowd will have its preferred products, with the emphasis on incorporating live video images within graphical frames. Quant jocks will bring their spreadsheets to life like a bunch of latter-day Baron von Frankensteins, no doubt terrifying the rest of us. *HyperCard* and its variants will battle for moral and technical supremacy, much as the *dBASE*-alikes are doing today.

Also, Tandy will offer its THOR CD recording technology. By then, the authoring tools should have bridged the seemingly unspannable chasms between users and standards, and we'll have arrived in a new age in which every software product is a (multi)media event. ■

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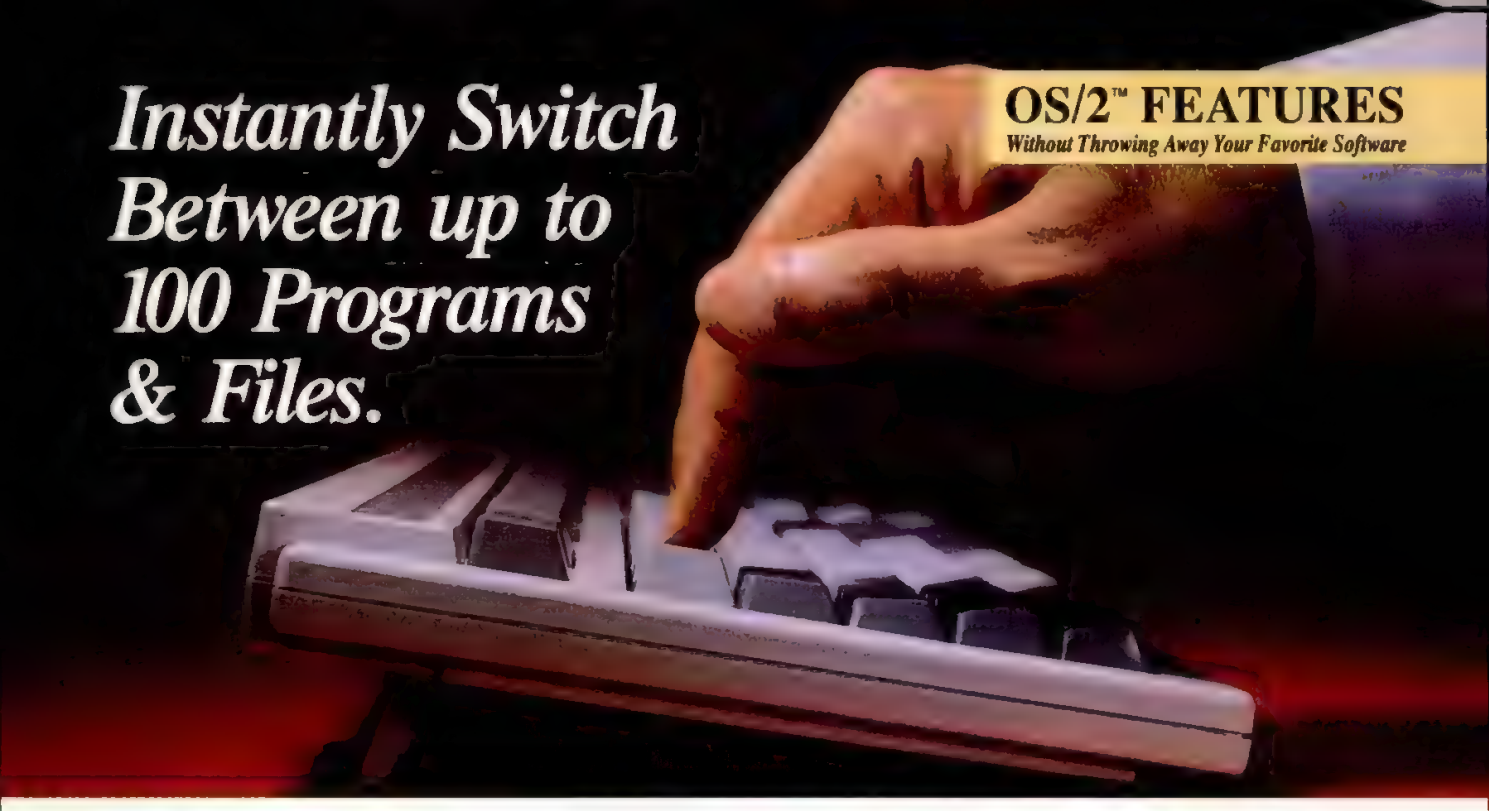
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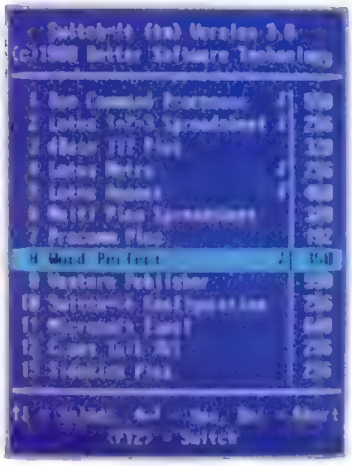


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John C. Dvorak



Couldn't Microsoft spend $15 to hire an artist with some taste? Dvorak's Axiom 43: A programmer who wears T-shirts and polyester pants shouldn't design screens.

Aesthetics is more important than performance. Perceived performance is more important than performance. User interface is more important than performance. Usefulness is more important than performance. And performance is important.

Let's talk about the aesthetics of *Microsoft Windows* and the Presentation Manager. Simply put, the *Windows*/PM interface is *ugly*. People like to say that it's "not sexy." Actually, it's beyond not sexy. It's so ugly that it offends the senses when it appears on the screen. I realized this recently when I noticed that I get one of those bone-shaking deep-in-the-body shivers when *Windows* comes up on the screen.

The animated Microsoft logo that's displayed when you start is almost appealing. But I really don't want a TV commercial to appear on my screen when I start *Windows*. It's like a shareware message. Get rid of it!

Then comes the Executive—a.k.a. the "user interface." Its colors are weird, its typeface is as ugly as a mud fence, and its little disk-drive symbols are creepy. PC monitors aren't really suited to reverse video, so the display looks muddy. The icons are eyesores, and the drop-down menus are hideous. Folks, this is one ugly interface.

The bad news is that Microsoft apparently doesn't understand that aesthetics takes work. In a recent memo floating around Microsoft Corp., NeXT, with its beautiful MACH interface, was said to be "ahead on prettiness via visual consistency and some nice 3-D illusions. Prettiness is their culture. . . . Performance is our culture."

The author (whose name was clipped out) goes on to make the hopeless comment that "lotsa people can do pretty, not so many performance." I don't think so. In fact, far fewer people can "do pretty." Performance is governed by engineering principles, which can be taught. Pretty is governed by artistic temperament, which can't be taught.

The belief that Microsoft can "do pretty" on demand (although it never has done so) is about as dopey as the typical engineer's remark that "marketing is easy; it's just common sense." It's the classic delusion of the techno-nerd.

This strange memo also says that NeXT is "ahead in Press Perception of Coolth." Coolth? Exactly what "coolth" means isn't clear, but I think it means "like, cool, dude." The memo then concludes, "We need to make more friends. We can do that." Gee, just like that?

AN ATTITUDE PROBLEM

So here's the attitude: "Like, I can be cool if I want to. And I can have more friends if I want to. And, heck, I can be an artist if I want to. It's just some paint. It can't possibly be as hard as what I do! I write hot code. *That's* hard!"

Yeah, right. Get a job, kid.

The irony of all this is that the public doesn't perceive Microsoft as a performance-oriented company. It is perceived as a big, well-rounded, honest, all-purpose software company that tries hard. That's a good image, but it's not an image of performance. I think that Microsoft products are feature-laden, sometimes to excess. But performance? Where?

One thing's for sure—the company hasn't



ILLUSTRATION: PETER BONO

the soul of an artist. Even Lotus projects a better sense of aesthetics than Microsoft.

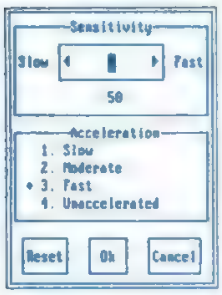
Taste is something you don't miss if you haven't got it. In other words, don't expect *Windows* Version 3.0 to look much better. They'll probably just change the fonts and add some shading and think that it's pretty. I'll still shudder when it comes up on the screen, and the memo writers will blame everyone but themselves.

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John C.
Dvorak

Inside Track

While everyone likes to think that all the old-timers haven't kept up with changing technology, most of them have. Take the old **CP/M computer maker** Morrow Designs (please!), now headed by the irascible George Morrow.

The former prexy of Morrow Designs, Bob Dilworth, went to **Zenith** to head up most of the laptop action there, until he quit a year ago for some easy-money job. Dilworth brought with him to Zenith none other than Howard Fullmer, who is largely responsible for the Zenith laptops, including the MinisPort. Fullmer has been in the microcomputer business from its inception, and he was also at Morrow as chief engineer. He was the guy who was largely responsible for the **famous portable** that won the IRS contract a few years back.

George Morrow, meanwhile, has been writing columns and looking for a **new idea.** He figured he has been out of the action too long, and he now intends to outdo everyone by designing **two killer laptops.**

One, which will be shown at Comdex, will be manufactured by a Korean computer maker. It will have a new full-page backlit **super** black-and-white display, a 386 processor, a 20- to 40MB 2.5-inch hard disk, and a removable 2-inch floppy module. It will run for 4 hours or more on replaceable C cells. It will be about the size of a Toshiba 1000 and cost less than $2,000. (Hey, I'll believe anything!)

> A powerful notebook computer is going to sell for less than $600. "It will kill the competition!"

The second killer laptop will be a **powerful** notebook computer designed to sell for less than $600. "It will **kill** the competition and can be easily done," Morrow tells me. He says he has **invented** a new power-management scheme that allows him to run the 386 on batteries and to **stretch overall battery life by 100 percent.**

Morrow says that too many laptop makers have gotten themselves into the battery business with all of the proprietary batteries they sell for their machines. This just adds to the cost. People would rather use off-the-shelf batteries or commercially available rechargeables. I tend to agree. Who needs a house full of **weird** batteries that cannot be interchanged?

The big secret in these Morrow-designed machines, though, is the use of the **new RF data channel adapters**, which are similar to those **marketed in Japan.** These are actually small transmitter/receivers that are hooked to the serial port connectors on your laptop and desktop machines, so that each has its own small antenna. When you carry your laptop into the room, the transceivers acknowledge each other and the laptop **instantly** becomes **a slave** for uploading and downloading via the RF serial port. **No wires, no connectors, no fuss, no muss.** This system is part of a secret project developed jointly with Traveling Software. I like the idea. Personally, I'm cabled out.

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A Programming Language Lives Dept.: APL89, which took place in New York last August, marked a new beginning for the famed language that was developed internally at IBM long ago. It's simply called "A Programming Language," or APL for short. It is the single **best** language for matrix manipulation. At APL89, even guitarist and recording artist Stanley Jordan was there to show how he uses APL code to score synthesizers. IBM was there to announce **a giveaway** of an **IBM "shareware"** package called TRYAPL2, a slightly crippled version of APL2, the **latest and greatest** version of the once-languishing language. There too was Stephen (*Mathematica*) Wolfram to discuss an APL/APL2 implementation of his own.

APL2 is the **hot topic** in the programming community. It's essentially 3-D APL, allowing you to place a matrix within a matrix and then manipulate it in all sorts of amazing ways.

If you're interested in APL, there is no better way to get started than with an excellent APL interpreter called I-APL (International APL). Designed for the educational market as shareware, you can obtain a copy (with on-disk documentation) for **a mere $6** from I-APL Ltd., 6611 Linville Dr., Weed, CA 96094; (916) 938-4684. Ask for Ed. Folks, this is **a steal.**

Since APL utilizes all sorts of **weird characters,** you may want some keyboard overlays from the keyboard-overlay specialists: Hooleon Corp. of Cornville, Arizona. (No, I don't make up these names!) Phone number: (602) 634-7515. They charge $29.95 for APL keys or for any **oddball keys** you may need.

The first release of APL for the PC, years back, required a new ROM because of the character set. Now, the programmability of the new EGA and VGA display cards means that APL will have **a second shot at popularity.** If you like to program or want to learn something new, check this out. It's a fascinating and powerful language. ■

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[1]*InfoWorld* July 17, 1989. • In Canada call 1-800-668-1509. Ask for Department 17. © 1989 Lotus Development Corporation Lotus and 1-2-3 are registered trademarks of Lotus Development
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- Supports 80387 math coprocessor
- One 32-bit (available), four 16-bit & two 8-bit expansion slots
- 200 watt UL, CSA & TUV approved power supply (110V/220V)
- ROM-based setup
- Extended BIOS functions to enable or disable shadow RAM, EMS & interleaved mode
- Choice of 1.2MB or 1.44MB floppy disk drives
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CIRCLE 170 ON READER SERVICE CARD

Jim Seymour



In chasing the corporate dollar, network vendors neglect the cheap and easy solutions needed in homes and small offices. Here are two products that point in the right direction.

Bill Machrone, *PC Magazine*'s editor and publishing director, described in his column a few issues back his vision for PCs in the home. He used his family's array of personal computers and peripherals as an example of how integral PCs have become to our lives.

Bill concluded that the diverse computer needs of his four-person family were remarkably like that of many small businesses. And just as economies of space and capital expense are important for PCs in the home, they're important in small businesses as well. For example, Bill's wife and kids use PCs at home as much as he does, yet everyone shares one older LaserJet—making issues such as printer sharing important.

I share Bill's sense that many of us will soon be looking to organize the PCs and peripherals in our homes in ways that are akin to those of small businesses. That's often tough, though, because the needs of small business often aren't well met by the products available in today's PC marketplace.

My home has a number of PCs, printers, and so on, supporting a cluster of offices as well as the simpler joys of using a computer at home. And I've been down the path Bill says lies ahead of many of us, trying to find a way to tie all that hardware together. I've also spent a lot of time helping small businesses put together rational networking solutions (a fancy way of saying "affordable" networking solutions). So I thought I'd pass along a couple of hot tips on little-known small-scale networking products I've used.

I've gone through several rounds of networks myself, partly for evaluation, partly for my own use. Stops on that journey have included a superb 3Com 3+setup, a LANtastic hook-up, and an oddball but lovable sort-of-wireless system, CarrierNET.

Anyone who's worked with those systems knows that the 3Com setup is by far the most elegant, powerful, and sophisticated. Yet both the LANtastic and CarrierNET systems have special advantages for small businesses—and homes—that can outweigh the technical superiority of the 3Com system.

Artisoft's LANtastic is the slickest cheap LAN I know. At typical street prices, four or five machines can be connected for $1,000 or so. LANtastic also saves money by functioning as a peer-to-peer network: you don't need to dedicate one PC as a server.

SIMPLICITY'S THE KEY

LANtastic uses less RAM than any comparable network: just 13K to 40K, depending on how it's configured. At work, adding All Chargecards and EMS memory to networked PCs may be an acceptable solution for RAM-hungry network operating systems, but that's unlikely and inappropriate in small businesses or at home.

LANtastic can't match the throughput of big-time network operating systems such as those from 3Com and Novell. With four or five machines in the network, these heavyweights can beat LANtastic by a factor of five or ten to one. But performance isn't the essence of a small-business network; economy, ease of use, and ease of installation are. And LANtastic scores high in each of those areas.

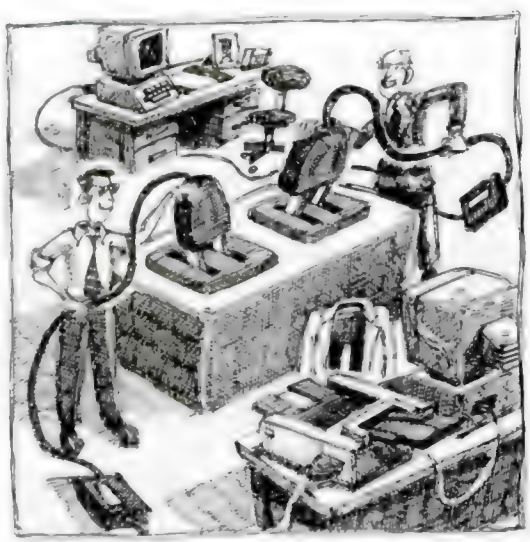


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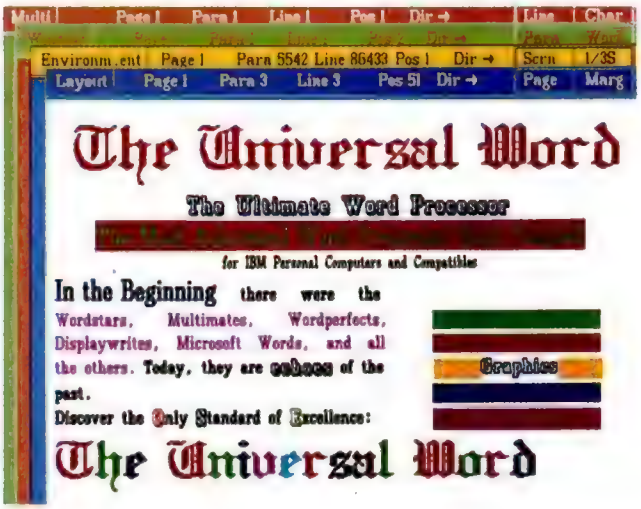
Carrier Current Technologies' CarrierNET, with its *ExcellNET* software, is my second hot tip for small-scale, low-cost networking. It uses what at first sounds like a goofy idea: running your data not over dedicated LAN wiring but through the AC power lines in your office or home.

Yep, it's scary the first time you plug one of those little CarrierNET boxes into your PC's

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CIRCLE 373 ON READER SERVICE CARD

Jim Seymour

serial port, then into the . . . wall jack. But you don't get sparks and smoke: instead you get slow but incredibly easy, flexible, and affordable networking.

When the CarrierNET product was originally launched (by another company), it had AC phase problems. But in the current version it works fine, as long as all connected PCs are on the same side of the building's main electrical transformer—and that's almost certainly the case in a small office or home.

My affection for CarrierNET grows out of a conviction that small-office and home networks are much more about file and peripheral sharing, and maybe electronic mail, than about executing network-version application programs off a central server. So while CarrierNET's 38,400-bps throughput is ludicrously slow compared with, say, Ethernet's 10,000,000 bps, in practice CarrierNET works well for the work it's called on to do in these installations. And not having to pull wire or pay someone to install the network means *huge* savings.

Finally, CarrierNET has one enormous advantage for those of us who rely on laptops and portables. Since the CarrierNET box is completely external to the PC—no networking card is required—hooking up or unhooking a portable is just a matter of plugging or unplugging a serial connector on the back of the PC. You're in business almost instantly.

Zero installation time and zero installation cost are among the features that make CarrierNET a winner for very small networks, especially those to which PCs are often being disconnected and reconnected. As long as you aren't in a big hurry, that is, and as long as you see these little boxes mainly as tools for data and peripheral sharing.

I wouldn't use CarrierNET for networking more than four or five PCs, but for that size and smaller nets it makes good sense. CarrierNET boxes cost $275 each, including *ExcellNET* software; add $50 per node if you want the electronic-mail version of *ExcellNET*.

The networked small office is an integral part of the PC world, and the networked home soon will be. But there are real issues of scale and appropriateness here: cheap and easy can mean a lot more than raw performance. ■

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- Ports: 1 Serial, 1 Parallel, 1 Game
- Clock Calendar with Battery Backup
- 8 Expansion Slots: one 32-Bit, five 16-Bit, two 8-Bit
- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
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Model 320

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- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
- Enhanced 101-Key Keyboard

Model 316

- Intel 80386-16 CPU running at 16/8 MHz
- **Landmark v1.1 = 20.1 MHz**
- 1MB of 32-Bit RAM expandable to 16MB
- Shadow RAM Option for Video and BIOS included
- Intel 80287-10 Math Co-Processor Socket
- Dual Floppy/Dual Hard Drive Controller with 1:1 Interleave
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William F. Zachmann



RISC may be a hot topic these days. But forgive me if I keep my bet with Intel.

According to a large number of supposed industry experts, just about all the PCs in use today are obsolete. And not just IBM-compatible PCs based on Intel 86 series microprocessors, but Motorola 680*x*0-based systems like the Apple Macintosh as well. That's because all these systems are based on CISC (complex instruction set computer) microprocessor designs which, they say, will be completely outmoded by newer microprocessors on the market based on RISC (reduced instruction set computer) architectures.

What are we to make of all this talk? Can it really be true that the Intel 386 and even the 486 are headed for the scrap heap? Are we unknowingly investing billions of dollars every year on technologies of the past?

Quite simply, the answer to that question is "No. No way!" Despite all the hype about RISC, the reality, at least as far as the PCs that most of us actually use are concerned, is that the Intel 86 family will dominate the market through the 1990s. Understanding why, however, requires a look at what RISC is, what it does, and how it does it. It also requires us to examine some of the basic realities of the PC marketplace.

WHAT RISC AMOUNTS TO

The idea of RISC was developed in IBM's research labs in the late 1970s and early 1980s as an outgrowth of work done on a processor called the 801. To a considerable degree, RISC is a reaction to earlier trends toward increasingly elaborate computer architectures with increasingly complex instruction sets.

The instruction set of a processor consists of the fundamental *machine instructions* that it is capable of executing. Though programs can be written in assembly language, which corresponds directly to the processor's instruction set, programmers more typically use a high-level language such as COBOL, FORTRAN, BASIC, or C. With these languages, a compiler—itself a program—is used to translate each high-level-language statement into a set of machine instructions (called executable or *object* code) that can be executed directly by the processor.

Early computers necessarily had simpler instruction sets. As computers became more sophisticated, however, system designers added more and more machine instructions to handle complex but commonly required tasks.

The IBM 360 architecture, for instance, includes 16 general-purpose registers that form a small area of fast memory in the central processor for instruction and data address formation. All 360/370 software makes use of these registers as a sort of scratch pad for high-speed data access.

A standard convention for calling subroutines, used by practically all software on the market for IBM mainframes, requires storing and retrieving the contents of these registers in main memory. To make this easier to program, the 360's instruction set comes with two complex instructions, Store Multiple (STM) and Load Multiple (LM), that can be used to store and retrieve the contents of multiple registers.

Since the early 1970s, standard computer architectures have been designed with what

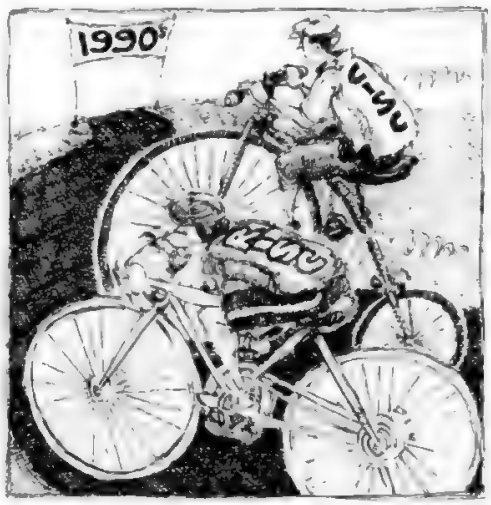


ILLUSTRATION: PETER BONO

amounts to an internal programming language to accomplish complex instructions. Called *microcode*, this is a core set of simple instructions that are in turn used to create the more-complex instructions in the processor's architecture. In this scheme, executing a machine instruction like Load Multiple or Store Multiple would actually run a microcode program that executes over a number of machine cycles.

By building these complex processors,

William F. Zachmann

hardware designers were in effect trying to bring their instruction sets closer to the constructs of high-level programming languages. But the overhead required to decode and execute these complex instruction sets can put a considerable drag on performance.

RISC represents a turning away from all this, going back to a simpler processor with a smaller number of instructions. In a pure RISC implementation, the instruction set *is* its own microcode. Each instruction can be executed in a single machine cycle, without going through the extra layer of microcode implemented in hardware.

In a RISC design, complex instructions are implemented in software rather than in hardware. The high-level language compiler, rather than microcode built into the processor chip, does the work of breaking down complex tasks into simple machine instructions and maximizing the efficiency of the program code. As a result, the processor itself can be more efficient, so in theory the program runs faster overall.

DON'T BET ON IT

In spite of the enthusiasm of its partisans, the reality is that RISC isn't going to take over the world anytime soon.

First of all, as radical as RISC is proclaimed to be, RISC processors aren't really all that different from conventional systems. Most so-called RISC processors on the market actually incorporate a number of relatively complex instructions. They are better described as *RISC-influenced* processors rather than RISC processors.

Second, the enormous performance gains claimed for RISC are more elusive in real life than they are in theory. RISC-influenced designs do offer advantages, especially in computation-intensive programs, but in most business applications the performance gains are quite modest. Thus, the dramatic edge claimed for RISC by its enthusiasts is way out of proportion to what the technology can actually deliver.

Third, for the majority of users, the real issue is not performance alone, but price per unit of performance. Widely used microprocessors such as the Intel 86 family are produced in such high volumes that their unit costs can be quite low. They therefore offer price/performance characteristics as good as or better than any RISC processor. And the design concepts of RISC can be incorporated into traditional microprocessor architectures, further improving the latter's edge.

But most important is the issue of upward compatibility for existing software. For users, the costs of moving from the Intel 86 family to an incompatible RISC-based microprocessor architecture, which would require new versions of every bit of software, are very steep. Users aren't going to make the move without a compelling reason, which RISC alone doesn't provide.

The bottom line is that regardless of all the hype, the familiar microprocessor architectures are going to be with us for a long time. Personal computers based on Intel 386 or 486 microprocessors aren't a dead end at all. They will continue to offer high performance at an excellent price, which should serve to keep them on top well into the foreseeable future. ■

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Norton SI Rating	2.1	13.4	19.01	23.0	20.5
Wait State	0	0	0	0	0
Standard Memory	640k	1 MB	1 MB	1 MB	1 MB
Shadow Memory	-	-	-	64 k	64 k
Cache Memory	-	-	-	32 k	32k
Co-Processor Slot	Yes	Yes	Yes	Yes	Yes
Expansion Slots 8 bit	8	2	2	2	2
Expansion Slots 16 bit	-	6	6	5	5
Expansion Slt 32 bit	-	-	-	1	1
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Parallel Ports	1	1	1	1	1
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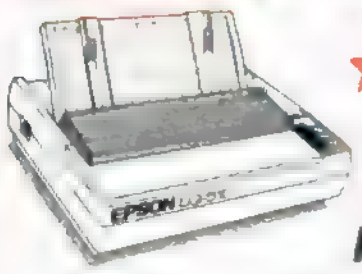
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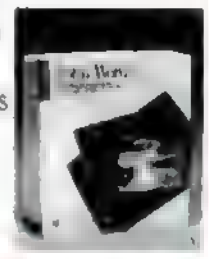
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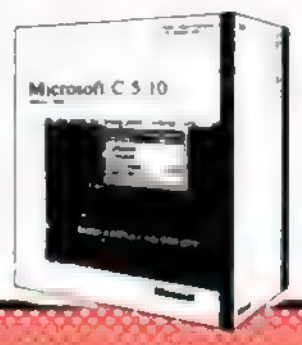
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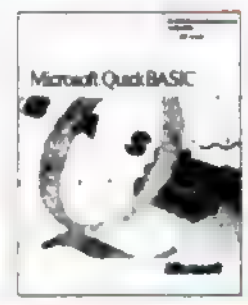


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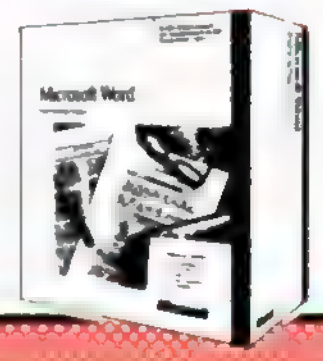
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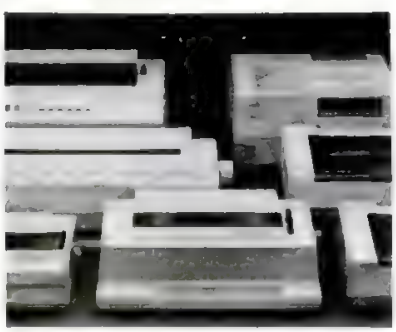
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CIRCLE 380 ON READER SERVICE CARD

Stephen Manes



Our cantankerous columnist finds a program he really likes—one that makes no claims to artificial intelligence but turns out to be smart as a whip.

What's the most important thing about a file?

To DOS, DOS shells, *Microsoft Windows*, and OS/2, the answer is the file's name—along with its size, its time of creation, and its place in the subdirectory scheme. To the Macintosh (and, soon, to Presentation Manager and IBM's *OfficeVision*), the answer is the application that created the file; the "this-is-a-file-created-by-application-X" icon takes up more room on the screen than the filename itself.

But that stuff is more important to a computer than to you. How often do you care which application created a particular file? How often do you need to know how big a file is? The most important thing about a file is the information in it—its *content*.

In this approach—putting the content of your files above all else—lies the genius of Lotus's *Magellan*. Its unique intimacy with content means that *Magellan* can do magical things, such as making the guts of your files as accessible as their names.

I had seen one too many bloated second-rate programs like *Metro* and *Express* emerge from Lotus boxes to expect much from *Magellan*. I guessed it would resemble *Agenda*—complicated, irritating software that requires eons of learning and millennia of data entry.

Then came executive editor Bill Howard's glowing First Looks report (*PC Magazine*, June 13, 1989). Friends and acquaintances kept touting the program. PC MagNet users rhapsodized over it. A mere month or two after its release, *Magellan* seemed to have acquired a cadre of users as fanatic as Wrigley Field bleacher bums. And this time the fanatics are right.

The hardest thing about setting up *Magellan* is installing the manual in its binder. You do have to wait a bit for *Magellan* to index every word on your hard disk—but once that's done, a quick update keeps things current, and the program knows what to update and what not to. *Magellan* doesn't waste time or space indexing .EXE, .COM, or other files unlikely to have text in them—but it can if you so specify. That kind of intelligence is what's singularly impressive about the program. *Magellan* continually makes smart guesses so that you don't have to.

Magellan's smarts are particularly evident in its most crucial feature—its "viewer" technology. The DOS TYPE command and most utility programs display file contents in pure ASCII or hexadecimal representation, neither of them terribly useful with anything but plain-vanilla text files. Peter Norton and others eventually developed viewers—utilities that can display *Lotus 1-2-3* worksheets or *dBASE* files as though the application had loaded them.

CONTENT TO BE SMART

But with more than a dozen viewers of its own for popular formats, *Magellan* actually knows from a file's contents (not its extension) which program created it and which viewer will best display it. So, unlike most so-called "personal information managers," *Magellan* doesn't force you to work its way. It helps you see and manage your personal information no matter how you created it (within limits—odd files such as *Q&A*'s don't have viewers yet).

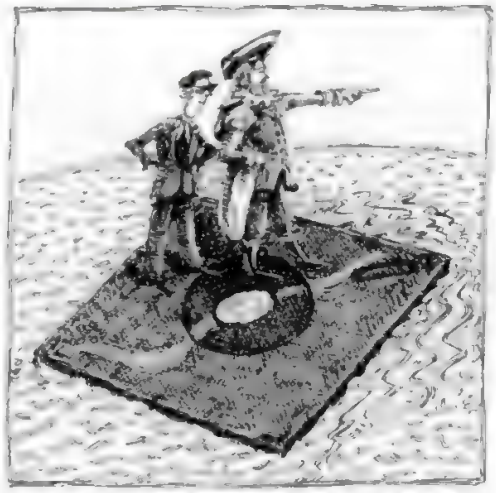


ILLUSTRATION: PETER BONO

This feature alone would make *Magellan* the DOS shell of choice. Pick a filename at screen left, and at the right you see the file as though you had loaded its parent application — only much faster. Tap a key, and you can move around in the file. Tap another, and you expand the window. It's as though a dense fog has suddenly lifted from your data.

The viewers take *Magellan* beyond the usual range of functions available in good

Stephen Manes

DOS shells. For example, the Gather command lets you mark information on the screen and paste it to an ASCII file, allowing you to combine fragments from incompatible sources—say, a *WordPerfect* file and a *dBASE* file.

By using the viewers' output, *Magellan* can effortlessly handle even *DisplayWrite*'s EBCDIC files and *MultiMate*'s oddball file structure.

With most free-text retrieval systems, indexes gobble a huge amount of disk space—anywhere from 50 to 100 percent of the original size of the files. With *Magellan*, the index overhead is at most about 8 percent. This compression prevents certain classic search strategies, such as proximity searching and Boolean searches with elaborate parenthetical groupings. But how often would you ask for "Bush" WITHIN FOUR SENTENCES OF "Willie Horton" or "Dukakis" NOT ("Kitty" or "Liberal"), anyway?

To compensate, *Magellan* offers what it calls "fuzzy searching." Just type in a search request (or reuse one from the past—*Magellan* wisely stores the last 60K of them). The program analyzes which documents would interest you most and displays the likeliest candidates at the top of the list. Search for "Bill Machrone," and a file with multiple mentions of our peerless leader appears at the top of the list. A memo about Bill the Cat would turn up somewhere near the bottom.

This "relevance ranking" isn't entirely new to the world of free-text retrieval, but it's rare and it's amazingly useful. CD-ROM and on-line databases virtually never use it; *Magellan* proves they ought to. Which would you rather your assistant handed you: a pile of memos in the order they arrived or the same memos in the order of their urgency?

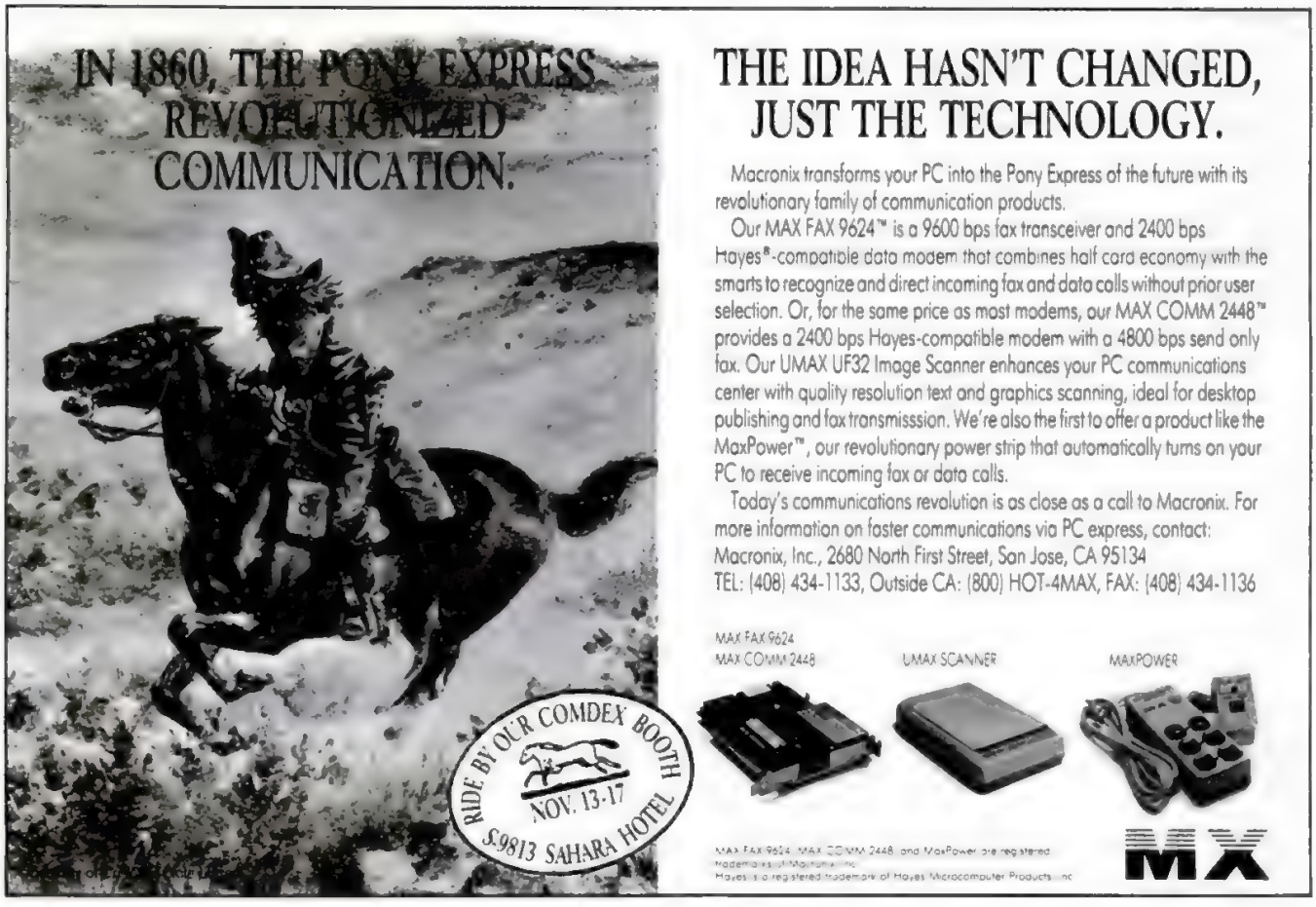
You can also launch applications from within *Magellan;* it stores a tiny portion of itself in RAM to seize control when you exit. *Magellan* can automatically associate applications with filename extensions or with subdirectories, so you can launch straight from a file. You *can't,* alas, launch an application based on the viewer associated with the file—perhaps the most disappointing omission.

There are others. There's no support for displaying graphics files. Certain viewers wrap lines less than optimally. Printing functions are Flintstonian. The search engine finds plurals and common word endings, but can't find substrings or use wildcards. Though generally fast and sensible, the user interface is utterly nonstandard and occasionally confusing.

But these problems should be addressed in the next version. Lotus is already developing new viewers as well as offering a roll-your-own developer kit. Powerful stuff: viewers can already display the directory information in compressed (ARC and ZIP) files. In theory you could display *dBASE* information precisely as it appears in your database application. There may come a time when new programs routinely include their own *Magellan* viewers.

Magellan was developed by the same team that developed HAL, the *1-2-3* add-on whose best functions were added to Release 3.0. That experience may point to the one limit to *Magellan*'s success: The program is so good that operating-system designers might just be inclined to steal its best moves.

They ought to. ■



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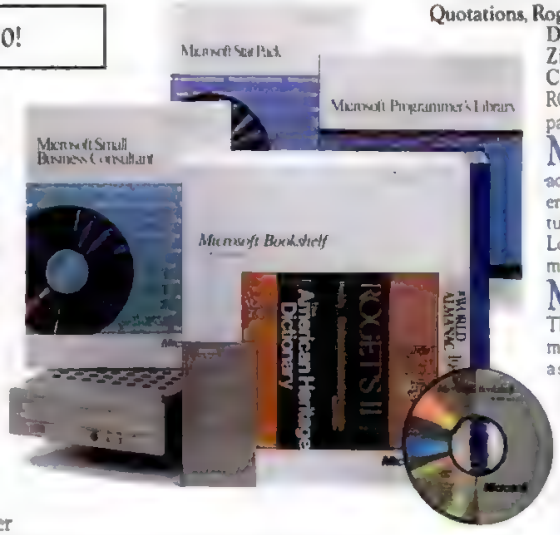
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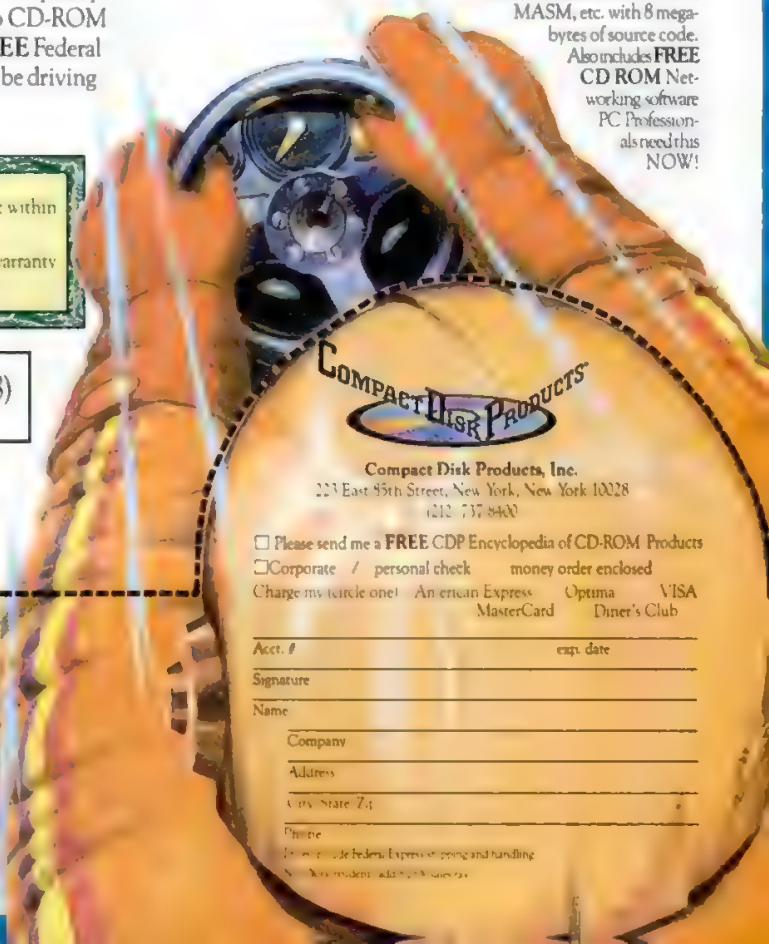
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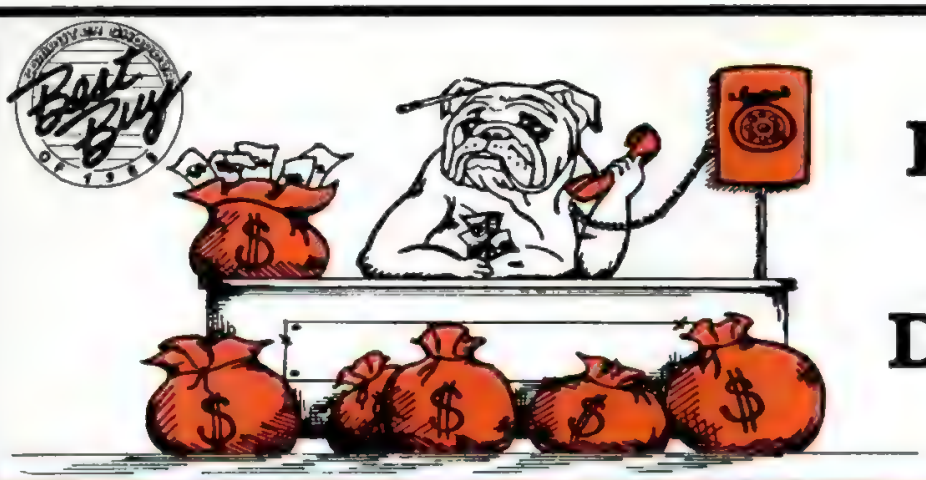
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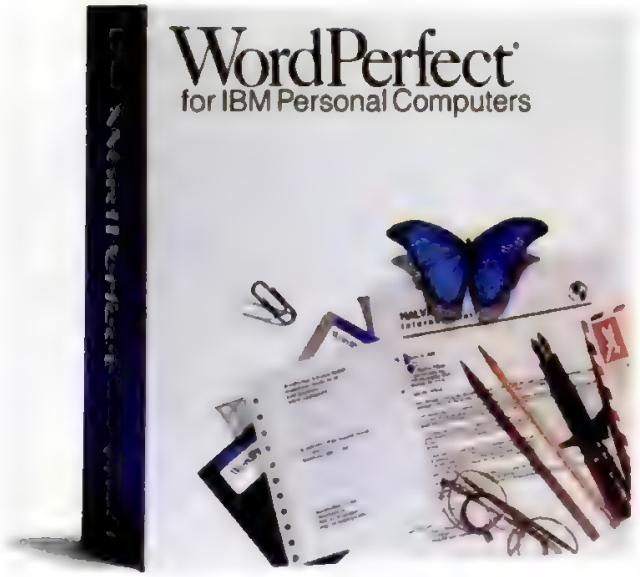
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HIGH-RISE COMPUTING

22 Powerhouse PCs Top Off at 33 MHz



ILLUSTRATION: FRANK RILEY

by John Dickinson

Despite the looming shadow of the 486 computer, 33-MHz PCs are flooding the marketplace and redefining the state of the art. Today's screamers? Or tomorrow's midrange?

You can look at the 22 33-MHz 386-powered PCs tested here in one of two ways: either they are the high end of today's PC marketplace—the fastest, most expensive desktop computers you can buy—or they're the ho-hum, midrange desktop computers you might want to consider tomorrow.

The reason behind the first viewpoint is obvious. There are no machines faster or more sophisticated in the PC arena today. Any of the 33-MHz 386s tested here defines the state

of the art in desktop computing—PCs that nobody need bother considering unless they're serious CAD users, graphic artists and animators, financial types with time-critical trading applications, or LAN administrators. That's not to mention the inevitable CPU-speed junkies who simply must have the fastest thing in town straddling their desktops.

The second viewpoint is less clear today than it will be early into next year. By then, Intel's new 80486 processor will be available in quantity. Systems built around the 486 will immediately dominate high-end PC computing because the new processor is considerably faster than a 386. As a result, you just can't think about any 80386-based PCs, these 33-MHz models included, without thinking about the 486.

SLOWER IS FASTER

While the initial run of the 80486 chip will be clocked at 25 MHz, the 486's greater on-board systems integration and other design factors will yield two to five times the processing speed of the 33-MHz 386s tested here. Doubling the speed of the 386 comes from a combination of the 486 machine's more efficient design and its 8K on-board static RAM cache and controller.

The 486's on-board cache serves to reduce the number of clock cycles required to fetch data from cached memory. A 386 processor using an external cache controller (such as Intel's 82385) requires two clock cycles to fetch 32 bits (one double word) of data from cache memory. The 80486's internal cache controller requires one clock cycle to fetch the same 32 bits from the on-board cache memory.

And for applications requiring a math coprocessor, even more performance gains are possible. The 486's on-board coprocessor works up to *five* times faster than the 80386's external 80387 because it doesn't need to relay instructions and data to—and receive results from—an external coprocessor. That saves up to five times the clock cycles required in the older design.

This same explanation applies to the 486's on-board cache. Although only 8K in size, by saving clock cycles it proves even faster from a system standpoint than a 64K cache external to the system.

That sort of performance should turn *all* 386-based PC's into midrange computers, 33-MHz models included. At least that's the game plan Intel had in mind when it decided to make the 80486 a fully compatible extension of the 80386 architecture. Unlike the drastic change from the 80286 to the 80386, wherein the newer chip could do things the old one never even dreamed of, the 80486 does nothing the 386 cannot do. It just does its job a whole lot better—and faster.

LABS BENCHMARK TESTS: GETTING PERSPECTIVE ON THE 386

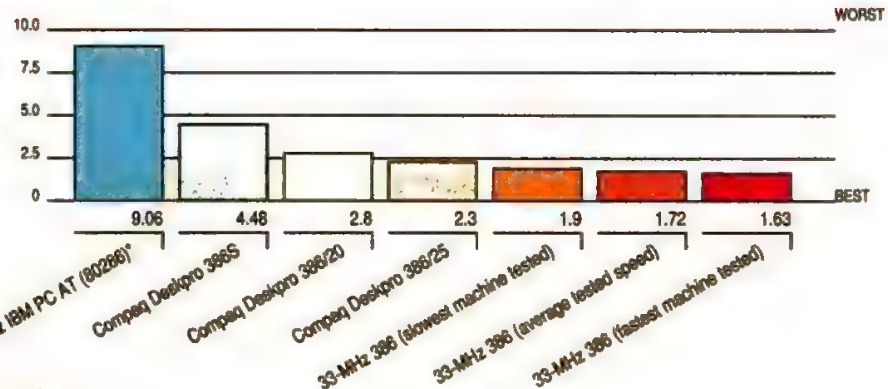
It's no wonder that Intel has been paying so much attention to the 486 processor, judging from the similarity among the 33-MHz machines' benchmark test scores (as reported here and later in this story). True, the 80386 Instruction Mix test results on this page show the 33-MHz category rising significantly above the representative 25-MHz Compaq model (as each new speed category has surpassed its predecessors). But the point spread among 386/33s is far less dramatic.

Enhancements to the AT architecture such as processor RAM cache are helping memory — a traditional bottleneck — to keep pace with the processor. Vendors are producing machines that let out all the stops in terms of speed. The result: a flurry of machines with little to set them apart, except for variations in their hard disk performance.

Instruction Mix

Elapsed Time (seconds)

The **Instruction Mix** benchmark test times a series of tasks specific to the 8088, 80286, or 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



* The 8-MHz IBM PC AT was tested using the 80286 Instruction Mix benchmark test, which uses a subset of the 80386 processor instruction set.

CACHE BONUS: Faster Speeds with Slower Memory

by Winn L. Rosch

Since the introduction of 16-MHz and faster PCs, processor RAM caches have become the most popular way of mating fast microprocessors with slow memory chips. By using a small block (typically 32K to 128K) of fast but expensive static memory as a cache, designers can construct computers using much more affordable, though more laggardly, dynamic memory chips.

Some method of matching memory to processor speed is mandatory because when a 33-MHz computer operates with zero wait states, it needs to access memory every 33 nanoseconds; only fast static RAM chips work at such speeds. Affordable dynamic memory chips instead require 60 to 80 ns. between accesses. With an effective cache, the majority of machines in our roundup are able to use even cheaper 100-ns. DRAM chips.

The cache is what bridges that difference in speed between the processor and the slower DRAM. The processor is connected only to the fast memory of the cache, which can slow itself down to communicate with main memory. The cache controller anticipates the bytes of information that the processor will need for its next set of instructions and loads them from main memory into the cache.

The cache controller isn't clairvoyant: it essentially guesses which bytes to load into the cache from main memory according to an algorithm. The simplest algorithm merely assumes that the next bytes needed will be in the same address range as previously required bytes. The algorithm stuffs the cache with a block of memory at a time.

SUITING ALL NEEDS

Caching algorithms must also take into account the needs of OS/2, multitasking, and multiuser operating systems. Such caches need to hold bytes from each task so that they are available to the processor when execution shifts between tasks, on the order of 10 to 50 times a second.

When the cache controller does not properly anticipate what the processor requires, the processor must wait while the cache retrieves the necessary bytes from main memory. This slows the system to main memory speed by piling on processor wait states.

Computers further complicate cache designs. Besides the processor, other devices such as a DMA (Direct Memory Access) controller may change main memory, and those changes must be constantly reconciled with the cache. Likewise, when bytes are written to the cache, main memory must immediately be updated.

A properly designed cache can increase the throughput of a computer beyond even what its processor speed might seem to allow. Both EISA and Micro Channel computer designs allow for the system processor to work on data in cache memory while other system components deal with main memory, thereby achieving a limited degree of parallel processing.

The principal measure of the quality of a cache is its "hit rate." The hit rate is the percentage of the time the processor operates without wait states. It varies with the algorithms used by the cache controller and the size of the cache. A larger cache naturally has a higher hit rate because it's more likely that a given byte will be in the cache. A 32K cache can yield a hit rate of better than 90 percent.

Such high hit rates are possible with off-the-shelf components like Intel's 82385 cache controller. Squeezing the most performance from a system, however, requires fine-tuning the cache. The fastest PCs use proprietary cache circuits—and manufacturers keep their designs as secret as the formula to Coca-Cola. ■

BUMPING THE 386 CEILING

Intel does not currently plan to make its 80386 processor go any faster than the 33-MHz-rated chips used in the PCs tested here. According to marketing and engineering staffers at the company, the 25-MHz 80486 will fulfill the next performance step required of high-end machines.

The marketplace for PCs, however, is finicky; it may yet force Intel to change this game plan. But you can expect the 80386-33s to move further into the midrange as 486s move toward system speeds as high as 60 MHz.

The rest of Intel's processor strategy can be seen in the pricing of its line of high-end processors, including the hybrid 32/16-bit 80386SX. In quantities of 1,000 parts, the 80486 processor costs $950 per chip, while the 33-MHz 80386 costs $319—down $48 from its introductory price of $367 per chip when purchased in quantity. (Keep in mind that if you figure the price of the 80387 and cache memory—the capabilities of which are inherent in the 486—into the 386's price, the 486 chip actually offers more for less.)

The older and slower 16- and 20-MHz-rated 386 processors are priced at $189 and $201, or nearly the same price. Because those prices are only slightly less than the $249 price of the 25-MHz processor, Intel expects PC makers to abandon their 16- and 20-MHz 80386-based PCs in favor of faster 25- and 33-MHz models.

Intel is counting on its new, bargain-basement $80 price for the 16-MHz 80386SX to bring up the rear and form the basis for entry-level PCs based on AT-style architecture. When the 20-MHz version of the SX chip ships next year, the price of the current model will drop even further. Intel is betting that its SX pricing strategy will completely undercut the market for those high-performance 80286 processors made by Harris and AMD, which currently run in the $60 to $80 range for 16 MHz.

This scenario leaves the venerable 8-, 10-, and 12.5-MHz 80286 processors destined to move further downward, below entry-level business machines into home computing and other applications that don't require high performance. In the meantime, the by-now ancient 8086 and 8088 processors are expected to disappear from the desktop PC scene altogether, being relegated to laptops and use as embedded processors in industrial and commercial equipment.

The resulting scene? A 32-bit PC computing world that Intel plans to sustain, compatibly, for a long time. Time enough,

everyone should hope, for software engineers to catch up with it and develop decent multitasking software that can take advantage of the 386 and 486 processors and the PCs and operating systems designed around them.

TODAY'S KING OF THE HILL

Right now, though, the 33-MHz 30386 machines are at the top of the heap. The first thing to notice is that there are so many of them. When previous new generations of 386 processors upped the speed race from 16 to 20 and then 25 MHz, new PCs arrived from vendors in a slow dribble. Now they pour out in a torrent.

When *PC Magazine* produced the 386 issue, for instance (*PC Magazine*, May 30, 1989), there were 25 80386 25-MHz PCs available for review. That was 6 months after the 25-MHz processor was first released. Only 3 months after the 33-MHz processor's debut, there were 22 of these machines to test, with many more appearing every day. Intel engineers claim that the 33-MHz system boards are basically modifications of the earlier 25-MHz designs, which may explain why the new machines were introduced so quickly.

The machines we accepted for review had to be available in mid-June. They were to be VGA-equipped systems with 4MB RAM, a hard disk with at least 100MB of storage, a 25- or 33-MHz 80387 coprocessor, and a 32K or larger cache. Narrowly missing the review were the Precision Systems Group of Jacksonville, Florida, and CSS Laboratories of Irvine, California. Both companies submitted machines after the deadline. Companies whose machines weren't ready in time to be reviewed included Destiny Technology Corp., Focus Technology, Fortron Corp., Olivetti USA, Spear Technology, Systems Integration Associates, Tandon Corp., Trillian, and Wyse Technology.

Other companies expected to release 33-MHz models by the time this issue appears include American Mitac Corp., Business Microsystems, Dataworld, IBM, Sun Microsystems, and Tussey.

CLEAR LEADERS EMERGE

While most of these machines' designs may be modifications of earlier work, there's certainly more to it than that. According to PC Labs benchmark tests, clear leaders emerge among a pack of very fast also-rans. Winning performances are chalked up here by Northgate, ALR, and Everex, three companies known for high-speed performance. Also at the top is Compaq—which, at least here, suffered no slowdowns due to the company's concerns over compatibility.

The Deskpro 386/33 puts Compaq back into the performance game in a big way. The Deskpro's new VGA-compatible chip is so fast that, according to one PC Labs reviewer, "you can't even see it!" The machine also turns in exceptional disk, memory, and processor performance times.

With few exceptions, these 33-MHz 386 PCs performed about the same on processor and memory benchmark tests.

The ALR Flexcache 33/386 has an entirely new caching design that takes better advantage of the 33-MHz 386's superior speed. The other performance leaders implement designs originally developed for slower 386s. The Everex Step 386/33 continues the outstanding write-back design of the cache originally designed for the 20-MHz Step PC. A write-back cache is faster because it needs to write from high-speed cache memory to slower main memory less frequently than a standard write-through cache does (see the sidebar "Cache Bonus: Faster Speeds with Slower Memory"). As a result, most of the time it allows zero-wait-state performance for memory reads, but also saves time by writing back only to the cache.

To further aid performance, Everex has changed the system board to make it capable of holding the full 16MB of RAM the machine is designed to handle. Northgate achieves its sparkling performance through the write-back cache it pioneered, which for the Elegance 386/33 is available in 64, 128, and supersized 256K sizes.

With a few exceptions, the rest of the 33-MHz 386s perform about the same. The average machine tested here runs PC Labs' processor and memory benchmark tests about 35 percent quicker than its 25-MHz 80386-powered brethren. That's about what you should expect from machines whose driving clock crystals are 32 percent quicker. You can chalk the 3 percent difference up to measurement error. In fact, you can probably look through the statistics and figure out that these machines are so fast that, within the measurement error of PC Labs benchmark tests (0.05 seconds), many of these PCs cannot be distinguished from one another by performance alone.

Other benchmark statistics turn up hot disk performances in the Bus 386/33, Boss 386 3633, and FiveStar System 33/D. The new caching controllers used in these machines offer excellent performance when running the DOS File Access (small record) tests, indicating they will make excellent database machines. But Compaq still leads the pack in overall performance with its proprietary controller embedded in a Conner-made drive.

THE END OF AN ERA

The 33-MHz 386-based PC may signal the end of an era on several counts. While Intel may be able to get more performance out of its 80386 design, it hardly seems necessary, with 486 machines right around the corner. If faster 386s are made, the system boards you see here will probably be tweaked a bit, fitted with the new chips and clocks, and sold pretty much as is.

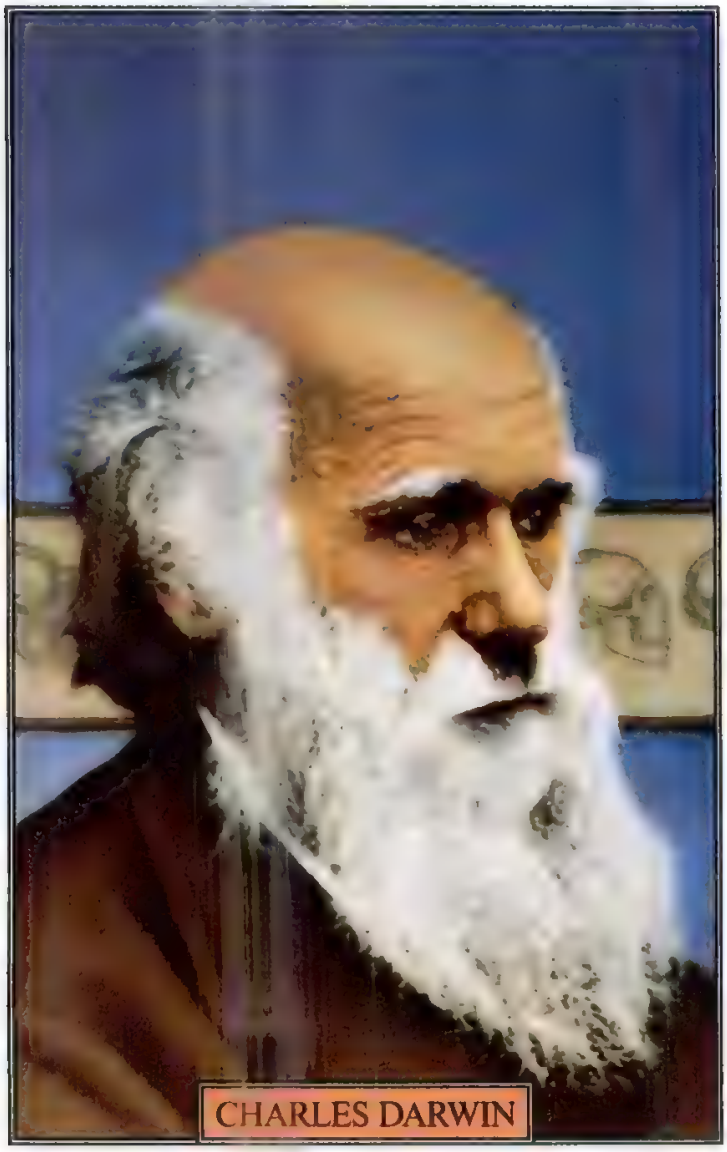
In addition, plenty of people think that AT-style system boards are out of the game from this generation on. It's not just the slow I/O bus speed of the AT bus that has people worried; it's the design's inability to multitask efficiently. That may not be important to you today, but it will matter for the next file server you buy. And it'll probably be important for your multitasking operating environment a year or two from now.

That leaves us with the next great debate in PC technology. Will IBM's Micro Channel architecture (MCA) bus take the lead, or will the Gang of Nine's Extended Industry Standard Architecture (EISA) bus take over? Either design offers superior speed, multitasking abilities, and a 32-bit bandwidth for faster I/O from disks and other peripheral devices.

Some of the first 486s will be built on AT platforms. But look for overall 486

For the features section of this issue, the associate editor was Edward L. Perratore and the PC Labs project leader was Bill O'Brien.

We Redefined The Evolution Of 2400 bps Dial-Up Modem Performance.



Photograph The Bettmann Archive.

Charles Robert Darwin, English naturalist, 1809-1882. His books *On the Origin of Species* and *The Descent of Man* established the principle of natural selection, and became the foundation of evolutionary theory for the next 100 years.

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performance winners to come out on 32-bit MCA and EISA system boards and define the turf where the battle of the high-performance buses will be won—or lost.

One thing is certain: these machines don't come cheaply. A sampling of the machines reviewed here shows that a system with 4MB RAM, a 150MB hard disk, VGA, and a 25-MHz 80387 coprocessor from PC Brand will cost you $5,900. A similarly equipped Austin 386/33 is $6,995, and these are machines at the lower end of the price spectrum. Northgate's Elegance 386/33 lists for $7,899, while ALR comes in at $11,666. Of course, the Compaq Deskpro 386/33's price tag (even with twice the hard disk capacity) doesn't escape notice: a 320MB ESDI hard disk system is $18,746.

Keep in mind that the last two are list prices, and discounts are common—figure 25 percent off for a Compaq at the dealer, for example. But the message is clear: if you want high performance, you're going to pay for it.

John Dickinson is executive editor, West Coast operations, of PC Magazine.



The ALR FlexCache 33/386 comes equipped with 4MB RAM, a 150MB hard disk, VGA, and an 80387 coprocessor for $11,666 in a hinged tower case offering easy access to the system board and expansion slots.

ADVANCED LOGIC RESEARCH INC.

ALR FlexCache 33/386

by Bruce Brown

Advanced Logic Research is an Irvine, California–based company that has made a solid name for itself in a few short years as an innovative designer and producer of high-powered personal computers. The company's FlexCache 33/386 will surely help that reputation: it is a very fast machine. It tied for first place with the Northgate Elegance 386/33 on the PC Labs 80386 Instruction Mix benchmark test and tied with the Compaq Deskpro 386/33 on the Conventional Memory test.

Performance comes at a price, however. The least-equipped ALR FlexCache machine—at $9,990—includes 2MB of RAM, a 150MB ESDI drive, built-in 800 by 600 VGA support (but no monitor), and a 1.2MB 5.25-inch floppy disk drive.

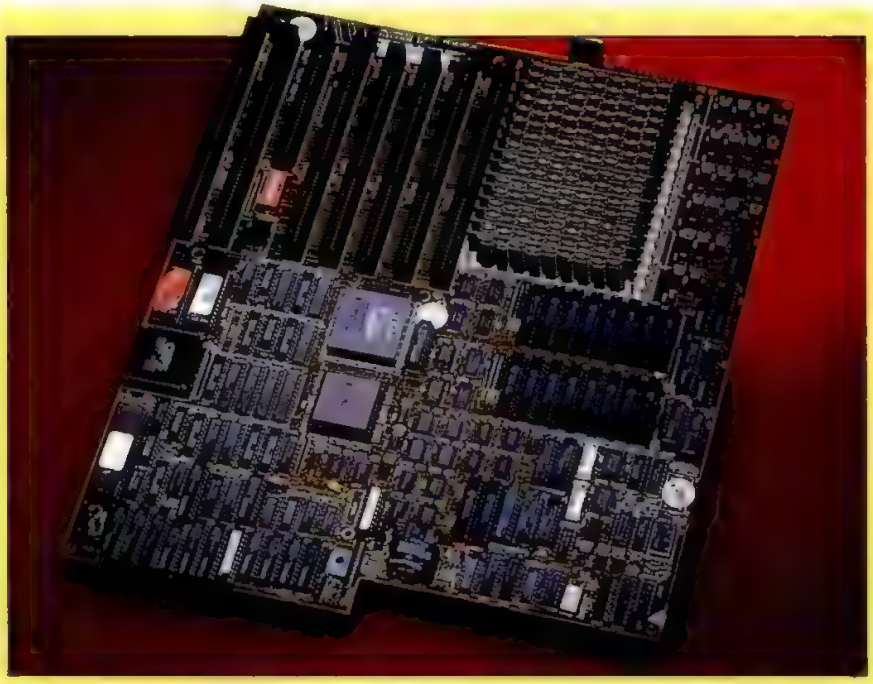
In *PC Magazine*'s standard configuration, with 4MB RAM, a VGA monitor, a 33-MHz 802387 coprocessor, and DOS 4.01 plus the hard disk, the system price increased to $11,666. Our test unit, which came with a 300MB hard disk, lists for $13,676.

MORE THAN PERFORMANCE

Your pennies buy more than just performance. The FlexCache 33/386 comes in an attractive vertical case with a ribbed black front-panel covering. The case measures 23.5 by 7.5 by 18.6 inches (HWD) with the system stand attached. The FCC Class A–rated machine includes a 200-watt power supply and can handle three half-height, one full-height, and two 3.5-inch drives.

The ALR makes use of all available space to let you load it up. The three half-height devices, for instance, can all use removable media. The full-height and one of the optional 3.5-inch internal hard disk drives install on a swing-out chassis that pulls out to allow access to expansion cards and the motherboard.

The ALR motherboard is the company's own design and uses a proprietary discrete chip to handle main and cache memory, as well as 80386 instructions. System speed is either 8 or 33 MHz, while the expansion bus runs at 8.25 MHz. The FlexCache is a 32-bit system with a dual bus setup so that memory and peripheral I/O can run at the same time. Both the main



Conspicuous by its absence is the missing 32 bit I/O expansion slot on this ALR motherboard. With SIMM sockets capable of holding up to 16MB of memory on the motherboard, there might not really be a need for one. Caching is proprietary and the overall design is clean; performance is among the fastest of the 33 MHz machines reviewed here.

PHOTOGRAPHY: THOM O'CONNOR

FACT FILE

ALR FlexCache 33/386
Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; (800) 444-4ALR, (800) 443-4226; in Canada, (714) 581-6770.
List Price: With 2MB RAM, 150MB hard disk, one 1.2MB 5.25-inch floppy disk drive, VGA adapter, utilities, $9,990; with 4MB RAM, VGA monitor, 80387-33 coprocessor, DOS 4.01, $11,666; with 300MB hard disk, $13,676
In Short: ALR's FlexCache design combines a 64-bit-wide memory path and a 128K 64-bit memory cache to produce a high-performance 33-MHz computer. Not surprisingly, the FlexCache 33/386 is one of the fastest PCs currently available.

CIRCLE 396 ON READER SERVICE CARD

memory and cache memory buses are 64 bits wide. The minimum 2MB of 60-nanosecond RAM can be expanded to a total of 16MB without needing a memory expansion card. The system board will accept either 256-kilobit or 1-megabit (Mb) SIMM chips, but you must use 1Mb chips for 16MB. The memory cache consists of 128K of 25-ns. static RAM chips.

The ALR system board includes one 8-bit and seven 16-bit expansion slots. One serial port and a parallel port are standard. In our standard configuration, five slots were free.

The ALR came with an unexciting Hi-Tek 101-key keyboard. Its 80-inch keyboard cable can be routed to either the left or right side of the keyboard, a nice touch to cut desktop cable clutter. Another good touch is ALR's documentation. The FlexCache 33/386 User's Reference Manual uses clear line drawings to explain the system layout and upgrade procedures. ALR also includes Intel on-site service standard with the 1-year parts-and-labor warranty.

The ALR FlexCache 33/386 is a high-end machine that hits good numbers in benchmark testing. Unfortunately its high prices may keep many from buying. ALR computers are sold only through dealers, the extra distribution layer being a reason for the high prices. Corporate users who want dealer-supported machines from a company with a reputation for building the highest-performance PCs could do well to look at the FlexCache 33/386.

Since all 33-MHz 386 machines are fast and many other brands are less expensive, ALR is faced with the same problem IBM and Compaq have: convincing potential buyers that the name on the front of the machine and specific proprietary design features are worth the high price.

OUR CONTRIBUTORS

Christopher Barr manages PC MagNet, *PC Magazine*'s on-line information service. All of the PC Labs benchmark series of tests used to compare these 33-MHz computers are available on PC MagNet.
Bruce Brown is a frequent contributor to *PC Magazine* and a computer consultant currently based in Simsbury, Connecticut.
Fredric Burke, formerly with *PC Magazine*, is the production editor for the medical journals *Gamete Research* and *Molecular Reproduction and Development*.
Susan L. Hayes is an editorial assistant at *PC Magazine*.
Robert W. Kane is a project leader at PC Labs.
Edward Mendelson is a contributing editor of *PC Magazine*.
Catherine D. Miller is a staff writer at *PC Magazine*.
Alfred Poor is a contributing editor of *PC Magazine* and an industry analyst who does much of his work in an electronic cottage located in Perkasie, Pennsylvania.
Winn L. Rosch is a contributing editor of *PC Magazine*.
M. David Stone is a contributing editor of *PC Magazine* and an industry consultant who specializes in communications. ■



Amax's PC/386-33 packs 4MB RAM, a 150MB SCSI or ESDI hard disk, two high-density floppy disk drives, VGA, and an 80387 coprocessor into its large tower case for $8,600.

AMAX ENGINEERING CORP.

Amax PC/386-33

by Susan L. Hayes

If you want performance, you're going to have to pay for it, especially when you're talking about 33-MHz performance. What a pleasant surprise it is, then, to find that Amax Engineering Corp., having OEMed systems and motherboards to other companies in the past, has come into its own to offer solid, competitively priced machines with service to match.

The Amax PC/386-33 in its tested configuration came fully equipped with 4MB RAM, a 150MB hard disk, TEAC 1.2MB and 1.44MB floppy disk drives, a 25-MHz 80387 coprocessor, and a Samsung monitor complete with Video Seven VRAM adapter, for $8,600, while *PC Magazine*'s standard configuration lists for $7,500.

Amax's tower design allows you to stash this FCC Class A–rated giant under your desk, leaving only the Samsung monitor and a well-constructed MaxiStart 101-key keyboard in full view. Even when the system unit is hidden, half-dollar-sized reset and turbo buttons and a large on/off switch are easily accessible to help reduce fumbling.

Inside the machine a plethora of quality parts awaits you. A 200-watt power supply sits behind six half-height drive bays, all of which are accessible from the front, and a Ray-O-Vac battery keeps time. Our test unit came equipped with a 150MB Maxtor hard disk and a Future Domain SCSI controller that can handle seven drives. Depending on customer preference, the SCSI drive can be replaced by an ESDI, or to cut costs, an ST-506 with an MFM controller.

MICRONICS MOTHERBOARD

The Micronics motherboard is no stranger to many 33-MHz machines. It accommodates an Intel 80387 chip (also replaceable with Weitek) and uses discrete logic technology, in addition to a few VLSI chips. Also in residence are a quality Phoenix



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Associative Crosshatching and Solid Fill 15 crosshatch patterns, ANSI specs 64 solid fills

Text Editing Word processing window Multiple font styles

On-Line "Help" system

Macro Programming Language

System Requirements 286 or 386 processor Microsoft Windows 2.1 or later 1 Mb internal memory or greater Windows-supported mouse

File Compatibility Autocad DXF Drafix CAD HPGL CDF, SDF for database information

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BIOS and the familiar Chips and Technologies chip set. With a 66-MHz crystal mounted on the motherboard, the Amax PC/386-33 can run at 8 or 33 MHz. The five 16-bit and two 8-bit expansion slots can be set to 8.3 or 12.5 MHz. With Intel's 82385 cache controller and 64K of 35-nanosecond cache memory, you have zero-wait-state performance; Amax shadows ROM and video BIOS in RAM.

The memory card that rests in the 32-bit proprietary slot contains RAM for the entire system. The Amax standard is to serve up static-column DRAM chips in 256-kilobit DIPs for a maximum of 4MB of RAM, but it's possible to order 1-megabit DIPs to give you a total of 16MB of memory. Amax performed respectably on the processor, memory, and hard disk segments of the PC Labs benchmark tests.

FACT FILE

Amax PC/386-33
Amax Engineering Corp., 47315 Mission Falls Ct., Freemont, CA 94539; (800) 888-AMAX, (415) 651-8886
List Price: With 1MB RAM, 40MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, *QA Plus* diagnostics, $4,625; with 4MB RAM, 150MB hard disk, VGA monitor, 80387-25 coprocessor, DOS 3.3, $7,500; with 150MB SCSI or ESDI hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, Video Seven V-RAM VGA card, 80387-25 coprocessor, $8,600
In Short: Video performance with the optional Video Seven V-RAM VGA card is disappointing, but otherwise the Amax PC 386-33 is a solid performer at a reasonable price

CIRCLE 397 ON READER SERVICE CARD

Although the results of the video benchmark tests weren't disastrous, they indicate that the unit's Video Seven VRAM VGA adapter is not as fast or innovative as promised. But the somewhat lackluster performance is not the fault of the VGA card alone. The same video adapter, when installed and tested in other machines, turned in faster times.

At the time of this review, the remaining pages of documentation describing the Amax PC/386-33 weren't ready yet. Not to complain too much, though—the company includes enough written information supplied by its various brand-name parts manufacturers that it's possible to live without Amax's own compiled version.

Buying the Amax PC/386-33 isn't taking a walk on the wild side: this cost-effective, sturdy machine has what is needed for reliable, fast computing.

AST RESEARCH INC.

AST Premium 386/33

by Christopher Barr

If we said AST's Premium 386/33 is the fastest computer on earth, like Joe Isuzu, we'd be lying. The system we evaluated was the slowest among the 33-MHz computers in this group of reviews, but not by much—this machine is fast.

AST designed the Premium 386/33 to allow you to configure it your way. The $6,595 list price gets you the basic 2MB of 32-bit RAM, zero-wait-state processing, a 1.2MB floppy disk drive, seven expansion slots, and DOS 3.3. A system with a 110MB 16-millisecond hard disk with embedded controller costs $8,595, and a Premium 386/33 with a 320MB EDSI hard disk and controller runs for $11,195. The evaluation system had 4MB of RAM, the 110MB hard disk, 16-bit AST VGA Plus video adapter, VGA monitor, and an Intel 80387 coprocessor; without the 80387 coprocessor, which AST doesn't sell, this system came to a list price of $10,090.

Memory, processor, and coprocessors are located not on the motherboard but rather on a CPU card. Also on this card is an Intel 82385 cache controller with 32K of 25-nanosecond static RAM. To further speed this demon along, the Premium 386/33 copies the system ROM BIOS and video BIOS into 128K of write-protected RAM.

The Premium 386/33 can handle up to 36MB of RAM with 4MB on the CPU card and 16MB of 80-ns. SIMMs on two optional add-on cards, which go in the two proprietary 32-bit slots. There are a total of seven slots: one 8-bit, three 16-bit, and three 32-bit. Even with a full complement of memory, the motherboard has three slots open, enough to accommodate the likes of a network card and a fax board.

The AST-manufactured system board sports a floppy controller that can handle three drives; in addition, it has two 25-pin serial ports and a parallel port on the system board. The Premium 386/33 also has an AT adapter interface that will let you use a hard disk with an embedded controller to save you another slot.



AST's Premium 386/33 is the slowest of this pack of race horses, but still very fast. With 4MB RAM, a 110MB hard disk, and VGA, this solidly built machine lists for $10,090.

WELL-MADE MACHINE

When you open the spacious cabinet, you immediately get the satisfaction of looking into a well-made machine. The layout is ordered, with cables neatly secured. Three half-height drive bays are accessible from the outside, and either one full-height or two half-height bays are available on the inside. AST uses a heavy-gauge steel, so this computer will be around for a while. Small details, like a flush-mounted reset button and a case lock at the rear of the chassis to preserve the clean look, further add to the feeling of quality.

AST furnishes superior documentation with the computer to get you up and running quickly. It has included a complete setup program in ROM that allows you to

FACT FILE

AST Premium 386/33
AST Research Inc., 2121 Alton Ave., Irvine, CA 92714-4992; (714) 863-1333.
List Price: With 2MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 3.3, GW-BASIC, utilities, $6,595; with 4MB RAM, 110MB hard disk, VGA monitor, $10,090. No 80387 coprocessor available from AST.
In Short: A solid, well-made computer, the AST Premium 386/33 has plenty of room for add-ons. With the serial and parallel ports as well as the floppy disk controller on the motherboard, you have five open slots that can hold an additional 32MB of 32-bit RAM and a networking card.

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PC MAGAZINE **September 13, 1988**
"Ahead of the Pack: The Hottest 386s"
"Built solidly, performs well... don't pass it over when you shop for your next power PC..."

May 30, 1989
"PC Labs tested 104 computers from 58 companies"
"Hertz Computer... reliability and quality are its sales tools... the machines exemplify the company's commitment to engineering dependable systems... they are the ones to look at if your priorities are dependability and reliability..."

INFO WORLD **November 14, 1988**
"InfoWorld looks at the eight fastest 386 machines"
"The Hertz 386/25 is a rugged desktop computer... extra thought went into the design... it passed our software and hardware test suites with flying colors... good value... excellent performance... well-trained support staff."

May 1, 1989
"The InfoWorld test center benchmarks 18 of the fastest DOS systems in the market."
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72MB	MFM	28ms	$ 4879	$ 5149	$ 5579	$ 5479	$ 5749	$ 6179
160MB	ESDI	16ms	$ 5599	$ 5869	$ 6299	$ 6199	$ 6469	$ 6899
330MB	ESDI	17ms	$ 6169	$ 6439	$ 6869	$ 6769	$ 7039	$ 7469
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configure the floppy and hard disks, toggle shadow RAM, or require a password before you have access to the system. You can also set the initial processor speed (4.77/8/33 MHz) and change the port addresses.

Compatibility is absolutely no problem. The review unit had a 110MB, 16-ms., 3.5-inch hard disk, with an embedded controller, which ran quietly. I loaded *Windows/386*, *Microsoft Excel*, Aldus's *PageMaker*, Micrografx's *Graph Plus*, and *Lotus 1-2-3*, Release 3.0; they all ran extremely well. I even loaded IBM OS/2, Version 1.1 (AST has Version 1.0 available and expects to have 1.1 ready by the time this review is published) and ran an OS/2 communications package without a hitch.

AST has a reputation for making quality hardware components, and the Premium 386/33 bolsters that reputation. Though not the fastest of the lot, the AST Premium 386/33 is a first-class computer and belongs at the top of your list.

AUSTIN COMPUTER SYSTEMS INC.

Austin 386/33

by Fredric Burke

Leading-edge computing often means a price to match. Austin Computer Systems' 386/33 successfully bucks that trend, using trusted components to achieve 33-MHz performance at a price that won't leave you debating the merits of less expensive machines. The result is a quietly capable computer that meets all your expectations, exceeds not a few, and is nowhere disappointing.

FACT FILE

Austin 386/33
Austin Computer Systems Inc., 10300 Metric Blvd., Austin, TX 78758; (512) 458-5106.
List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, utilities, $3,495; with 4MB RAM, 155MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, 80387-25 coprocessor, DOS 4.01, $6,995.
In Short: The Austin 386/33 is a sturdy screamer that combines good equipment with a price lower than that of some machines of lesser performance. Austin does not have the visibility of Compaq or IBM, but in an office environment as a CAD station or as part of a network, it will not disappoint.

CIRCLE 399 ON READER SERVICE CARD

While the basic 386/33 does not come with a monitor, video card, or a hard disk, $3,495 will buy 1MB of RAM, a choice of a 1.2MB or 1.44MB floppy disk drive, either a Key Tronic or Hi-Tek 101-key keyboard, and a 1-year parts-and-labor warranty that includes free on-site service, courtesy of GE. Extended 2- to 5-year service contracts are available as well. The review unit as tested included 4MB RAM, a 155MB hard disk, both floppy disk drives, VGA monitor, a 25-MHz 80387 chip, and DOS 4.01 for only $6,995.

Look inside the big, AT-size box, and indeed, all the right bits are there. Austin uses name-brand parts including a Micronics motherboard, Western Digital drive controller, CDC and IDE hard disks, and Mitsubishi monitors. Setup proved to be disarmingly simple, and the manual was

THE 8-MHz BUS: Time for a Change?

by Winn L. Rosch

Squeezing rocks through a funnel—that's the unenviable job a 33-MHz microprocessor faces with the 8-MHz, 16-bit expansion bus of the typical high-performance PC. The slow, narrow bus so constricts the flow of data that on many tasks, today's top-of-the-line 33-MHz 80386 may hardly perform faster than yesterday's 16-MHz model.

Of all the components of a modern PC, the most archaic is the expansion bus. Originally designed in more easy-going times, its performance matches the information-handling capabilities of the AT's 16-bit, 8-MHz 80286 microprocessor.

The AT bus clings to life for one reason alone: compatibility. Its 8-MHz speed is the only guarantee that the vast majority of PC expansion boards will work in a given computer.

The downside of the old-time design is devastating. Whenever a 33-MHz PC has to use its input/output bus, it must drop to one-eighth speed or less because of the slower speed and narrower (16- versus 32-bit) data path of the expansion bus. In some situations, up to 90 percent of your system's operations may be I/O-related—mass storage, communications, and video data all ride the bus—constraining even the fastest 33-MHz 386 to AT speed.

THE CONSEQUENCES

Exactly how much you suffer depends on the software you run. Programs that make heavy use of disks, such as databases, will benefit least from faster computers because of the bus limit. Of course some I/O operations, such as information transfer through serial ports, have their own inherent speed limits and slow things further.

The worst handicap you can impose on a system is to load the bus with memory. EMS and extended memory boards in normal expansion slots can drag down a fast system's performance precipitously. To avoid bus speed limits with expansion RAM, most manufacturers have added proprietary memory expansion slots that detour around the bus route.

While this technique allows additional memory to run at system speed, it limits your choices and increases your costs for memory expansion. Moreover, such a split bus does nothing to speed up expansion boards like disk controllers or video adapters that are still confined to 8-MHz slots.

Upcoming EISA computers will speed some I/O transfers with two novel design twists. A special connector will allow 32-bit bus width in expansion slots that will remain compatible with 8- and 16-bit boards, while a new EISA data transfer mode will allow future expansion boards to move information at a speed equivalent to that of the processor.

IBM's Micro Channel architecture (MCA) abandons the conventional bus—as well as expansion board compatibility—entirely. Current MCA designs operate at 14.3 MHz, almost twice the rate of the industry standard. Future MCA machines will deliver even faster bus speeds.

The bottom line: if you run applications that depend on lots of I/O operations, you may be surprised by how slight a performance increase you'll get by moving up to 33 MHz. For the full benefit of today's fastest processors, you need a newer bus design. ■

clear and helpful on technical matters.

The 386/33's seven slots—five 16-bit and two 8-bit—run at either 8 or 11 MHz. Switching bus speeds is inconvenient because in order to do so, you have to go in and fiddle around with DIP switches. Processor speed can be configured to 6, 8, or 33 MHz by using the Setspeed utility disk. Since the rest of the machine is pretty well sorted out, why Austin chose not to extend this to changing bus speeds is something of a mystery.

EASY EXPANDABILITY

Expandability isn't a problem; there's room for another half-height storage device in the front bay, and after adding a video and floppy and hard disk controller cards, you'll still have four slots available if you're using a 130MB or 155MB hard disk, or five slots free when going with a smaller disk in the 40MB to 110MB range.

The FCC Class A–rated 386/33 is a zero-wait-state machine with 1:1 memory interleaving, a 25-nanosecond 64K static RAM cache that uses dual Intel 82385 controller chips, and shadow RAM for the memory and video BIOS.

Austin can load up its proprietary 32-bit memory board with up to 4MB in 1-megabit chips. An optional daughterboard can be populated with a further 8MB of RAM,



The Austin Computer Systems 386/33 holds no surprises but comes complete with 4MB RAM, a 155MB hard disk, two floppy disk drives, VGA, and an 80387 math coprocessor for only $6,995.

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

The following commentary analyzes some of the terms in this table of features. The phrases in bold type are listed in the same order as in the left-hand column of the table.

Basic configuration This price represents the most stripped-down machine the vendor will sell, typically including 1MB RAM, one floppy disk drive, and serial and parallel ports.

Hard disk options The number of different hard disks the vendor offers for a machine is often indicative of how much customizing is available.

Standard configuration For the sake of price comparisons, our "standard" configuration normally includes 4MB RAM, a 100MB hard disk, at least one floppy disk drive, a monochrome monitor, at least one parallel and one serial port, DOS, and a keyboard. Because the "standard" packages cited here may differ from this configuration, the price of each system is followed by the size of the hard disk (if other than 100MB) and any other departures from our specification.

Tested configuration The specifications of the evaluation units depend on what configuration each manufacturer has sent us (based on our guidelines).

Bus clock speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 or 10 MHz. Time-out periods, sometimes called **wait states,** are often used to slow down the bus.

Disk controller manufacturer and type (interface/encoding) Several interfaces are used to control the way data is transferred from the hard disk to the computer. The most common disk interface standard is the ST-506/412, used in the IBM PC-XT and PC AT. Two other common data transfer interfaces are SCSI (Small Computer System Interface) and ESDI (Enhanced Small Device Interface). Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers.

The **BIOS version and date** may affect PC Labs' benchmark test results. Those purchasing the same machine with a different BIOS version are likely to encounter some variations in performance.

Memory chip type Kb and Mb refer to kilobits and megabits, respectively.

Chip packaging Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs. The Dual In-line Package (DIP) is the traditional buglike computer chip sprouting 8, 14, 24, or even 40 or more metal legs (evenly divided between right and left sides). Single In-line Packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. Single In-line Memory Modules (SIMMs), on the other hand, are individual logic devices that are installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement duplicates the integrated structure of a SIP but allows for the possibility of replacing an individual memory component if necessary.

RAM chips RAM chips come in two basic types: static and dynamic. Static RAM chips (SRAMs) are faster and more efficient but costlier. Dynamic RAM chips (DRAMs) cost less and are more common, but the tradeoff is in slower processing and operation.

Interleaved memory CPU speed is usually faster than memory speed. Interleaved memory increases processing speed by splitting the memory into two or more portions. The CPU then sends information to a section at a time, allowing one section to process while another receives data.

Shadow RAM Shadow RAM is a technology that loads system BIOS and/or video BIOS directly into fast RAM on boot-up of the computer. The BIOS then operates much faster.

Disk cache software Some companies provide their own software to facilitate caching. Other computers can generally take advantage of the caching facility within some version of DOS.

Maximum 32-bit RAM Many computer manufacturers have designed their own 32-bit slots for memory expansion cards. The availability of such slots is especially important for a growing number of memory-intensive applications.

FCC certification class Two classes of FCC (Federal Communications Commission) approval may be given to computers: Class A and Class B. These classes concern levels of radio-frequency interference. With Class A approval, a computer may be operated in a business locale. The tougher Class B rating allows home use as well, where computers are likely to be placed near radios and television sets.

CONTINUES

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33-MHz 386-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

BASIC CONFIGURATION	PC Brand 386/33 Cache	V.I.P.C.-33 386	Polywell Polysystem 33 Cache	Austin 386/33	Bus 386/33	Tangent Model 333
List price	$2,799	$2,999	$3,300	$3,495	$3,799	$3,945
Basic configuration includes	1MB RAM, 1.2MB or 1.44MB floppy disk drive, one serial and one parallel port, DOS 4.01, *Microsoft Windows/386*	1MB RAM	4MB RAM, 1.2MB floppy disk drive, monochrome monitor, two serial, one parallel, and one game port, DOS 3.3 or 4.01, tower case	1MB RAM, 1.2MB or 1.44MB floppy disk drive, two serial and one parallel port, disk cache, utilities	1MB RAM, 80MB hard disk, 1.2MB floppy disk drive, monochrome monitor, one serial and one parallel port, DOS 4.01, utilities	1MB RAM, 67MB hard disk, 1.2MB floppy disk drive, monochrome monitor, two serial and one parallel port
Drive bays	5 half-height	5 half-height	5 half-height	3 half-height	7 half-height	10 half-height
OS/2	Unavailable	Unavailable	Unavailable	Unavailable	Version 1.0 ($350)	Version 1.0 ($395)
Hard disk options	7	4	40	5	9	5
Slots	Two 8-bit, five 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	One 8-bit, four 16-bit, two 32-bit	Two 8-bit, five 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit
Slots free with hard and floppy drives, video, two serial and one parallel port installed	4	4	4	4	4	5
Power supply (watts)	230	375	220	200	220	285
Keyboard cable length (inches)	72	107	82	72	90	78
STANDARD CONFIGURATION						
Price of VGA system with 4MB RAM, 100MB hard disk, 80387 coprocessor, DOS	$5,900 (150MB disk)	$6,098	$6,155	$6,995 (155MB disk)	$6,725 (120MB disk)	$6,488 (101MB disk)
TESTED CONFIGURATION						
List price	$5,900	$12,499	$6,890	$6,995	$11,000	$7,528
Tested configuration includes	4MB RAM, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-25 coprocessor, DOS 4.01, *Microsoft Windows/386*, tower case	8MB RAM, 160MB hard disk with Konan controller, 60MB tape backup, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-33 coprocessor, DOS 3.3, tower case	4MB RAM, 158MB hard disk, 1.2MB and 1.44MB floppy disk drives, Super VGA monitor, 80387-33 coprocessor, DOS 3.3, tower case	4MB RAM, 155MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-25 coprocessor, DOS 4.01	4MB RAM, 380MB hard disk with DPT controller, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-33 coprocessor, DOS 4.01, tower case	4MB RAM, 151MB hard disk, 1.2MB floppy disk drive, VGA monitor, 80387-33 coprocessor, DOS 3.3
Microprocessor clock speeds(MHz)	8/33	6/8/33	8/33	8/33	8/33	8/33
Wait states	0	0	0	0	0	2
Bus clock speeds (MHz)	8.1/11	8.25/11	8	8/11	8/11	8/8.25

—Editor's Choice

FiveStar System 33/D	Amax PC/386-33	Wedge Cache WT386-33C	Northgate Elegance 386/33	Boss 386 3633	Tri-Star Flash Cache 386[33]	BSM Identity 386-33	Dyna 33Series
$4,103	$4,625	$4,695	$4,799	$4,995	$4,995	$4,999	$5,016
1MB RAM, 60MB hard disk, 1.2MB or 1.44MB floppy disk drive, monochrome monitor, one serial and one parallel port	1MB RAM, 40MB hard disk, 1.2MB or 1.44MB floppy disk drive, one serial, one parallel, and one game port, diagnostics	1MB RAM, 1.2MB floppy disk drive, one serial, one parallel, and one game port, DOS 4.01	1MB RAM, 68MB hard disk, 1.2MB and 1.44MB floppy disk drives, monochrome monitor, two serial and one parallel port, DOS 4.01, GW-BASIC, utilities	1MB RAM, 40MB hard disk with DPT controller, 1.2MB or 1.44MB floppy disk drive, one serial and one parallel port, DOS 3.3	4MB RAM, 65MB hard disk, 1.2MB or 1.44MB floppy disk drive, two serial and one parallel port	2MB RAM, DOS 3.3 or 4.01	4MB RAM, 1.2MB floppy disk drive, two serial, one parallel, and one game port, DOS 3.3
5 half-height	6 half-height	6 half-height	5 half-height	4 half- and 1 full-height	6 half-height	6 half-height	6 half-height
Unavailable	Unavailable	Version 1.1 ($75)	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
4	3	8	7	4	4	Over 100	9
Two 8-bit, five 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit	Two 8-bit, six 16-bit, one 32-bit	One 8-bit, four 16-bit, three 32-bit	One 8-bit, six 16-bit, one 32-bit
4	4	5	5	5	5	4	5
200	200	275	220	230	220	220	275
72	72	96	80	90	90	72	72
$8,298 (150MB disk)	$7,500 (150MB disk)	$8,175 (158MB disk)	$7,899 (150MB disk)	$7,999 (120MB disk, no monitor or 80387)	$7,114 (110MB disk)	$9,845 (150MB disk)	$9,265 (147MB disk)
$8,298	$8,600	$8,175	$7,899	$7,999	$8,790	$9,999	$9,265
4MB RAM, 150MB hard disk with DPT controller, VGA monitor, 80387-33 coprocessor, DOS 4.01	4MB RAM, 150MB hard disk, 1.2 and 1.44MB floppy disk drives, Video 7 VRAM card, VGA monitor, 80387-25 coprocessor, DOS 3.3	4MB RAM, 158MB hard disk, 1.2MB floppy disk drive, VGA monitor, 80387-25 coprocessor, DOS 4.01	4MB, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-33 coprocessor, DOS 4.01	4MB RAM, 120MB hard disk, 1.2MB floppy disk drive, VGA adapter, DOS 3.3	4MB RAM, 150MB hard disk, 60MB tape backup, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-33 coprocessor, DOS 3.3	4MB RAM, 150MB hard disk, 1.2 and 1.44MB floppy disk drives, VGA monitor, 80387-25 coprocessor, DOS 3.3	4MB RAM, 147MB hard disk, 1.2 and 1.44MB floppy disk drives, VGA monitor, 80387-33 coprocessor, DOS 3.3
6/8/33	8/33	8/33	8/33	8/33	8/33	8/33	8/33
0	0	0/1	0	0	0	0	0
8.25/11	8.3/12.5	8/10	8/8.25	8/8.25	8/8.25	8	8

CONTINUES

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

BASIC CONFIGURATION	Gateway 386-33 Dream Machine	Micro Express 386-33	PC Link 386-33	Everex Step 386/33	AST Premium 386/33	Zenith Z-386/33
List price	$5,995	$5,995	$5,995	$6,199	$6,595	$7,999
Basic configuration includes	4MB RAM, 150MB hard disk, 1.2MB or 1.44MB floppy disk drive, multiscanning monitor, two serial, one parallel, and one game port, DOS 3.3 or 4.01	4MB RAM, 1.2MB or 1.44MB floppy disk drive, two serial and one parallel port, diagnostics	4MB RAM, 159MB hard disk, 1.2MB or 1.44MB floppy disk drive, one serial and one parallel port, DOS 3.3 or 4.01	1MB RAM, 1.2MB floppy disk drive, one serial and one parallel port, DOS 3.3	2MB RAM, 1.2MB floppy disk drive, two serial and one parallel port, DOS 3.3, GW-BASIC, utilities	2MB RAM, 1.44MB floppy disk drive, two serial and one parallel port, DOS 3.3, *Microsoft Windows/386*
Drive bays	6 half-height	5 half-height	5 half-height	5 half-height	5 half-height	5 half-height
OS/2	Unavailable	Version 1.0 ($275)	Version 1.0 ($295)	Version 1.0 ($325)	Version 1.1 ($340)	Version 1.1 ($349)
Hard disk options	5	6	2	4	2	2
Slots	One 8-bit, six 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit	Two 8-bit, six 16-bit	One 8-bit, three 16-bit, three 32-bit	Three 16-bit, four 32-bit
Slots free with hard and floppy drives, video, two serial and one parallel port installed	5	5	5	5	5	5
Power supply (watts)	220	220	220	200	220	200
Keyboard cable length (inches)	72	98	73	72	72	96
STANDARD CONFIGURATION						
Price of VGA system with 4MB RAM, 100MB hard disk, 80387 coprocessor, DOS	$6,720 (150MB disk)	$8,249 (150MB disk)	$7,868 (159MB disk)	$11,342 (160MB disk)	$10,090 (110MB disk, no 80387)	$15,395 (150MB disk)
TESTED CONFIGURATION						
List price	$6,920	$8,249	$7,868	$12,591	$10,090	$14,996
Tested configuration includes	4MB RAM, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, DOS 3.3, 80387-33 coprocessor, tower case	4MB RAM, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-33 coprocessor	4MB RAM, 155MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, 80387-33 processor, DOS 3.3	4MB RAM, 330MB hard disk, 1.2MB floppy disk drive, VGA monitor, 80387-33 coprocessor, DOS 3.3	4MB RAM, 110MB hard disk, 1.2MB floppy disk drive, VGA monitor, DOS 3.3, GW-BASIC	3MB RAM, 150MB hard disk, 1.44MB floppy disk, VGA monitor, 80387-25 coprocessor, DOS 3.3, *Microsoft Windows/386*
Microprocessor clock speeds (MHz)	8/33	8/33	8/33	8.25/16.5/33.3	4.77/8/33	8/33
Wait states	0	0	0	0	0	0
Bus clock speeds (MHz)	8	8	8.33	4.14/8.27/11.13	8	8.33

—Editor's Choice

	PC	
	ALR FlexCache 33/386	**Compaq Deskpro 386/33**
	$9,990	$11,198
	2MB RAM, 150MB hard disk, 1.2MB floppy disk drive, one serial and one parallel port, *PC-Kwik*, utilities	2MB RAM, 84MB hard disk, 1.2MB floppy disk drive, 16-bit VGA controller, one serial, one parallel, and one mouse port, *Compaq Expanded Memory Manager*
	4 half-height	1 third-, 4 half-, and 2 full-height
	Unavailable	Version 1.1 ($340)
	2	4
	One 8-bit, seven 16-bit	One 8-bit, six 16-bit, one 32-bit
	5	7
	220	300
	80	67
	$11,666 (150MB disk)	$18,746 (320MB disk)
	$13,676	$25,017
	4MB RAM, 300MB hard disk, 1.2MB floppy disk drive, VGA monitor, 80387-33 coprocessor, DOS 4.01	4MB RAM, 320MB hard disk, 250MB tape backup, 1.2MB and 1.44MB floppy disk drives, modem, Advanced Graphics video system with 512K memory upgrade, 80387-33 coporocessor, DOS 4.01
	8/33	4.77/6/8/33
	0	0
	8/8.25	8

CONTINUES

giving RAM-hungry applications up to 16MB of 32-bit RAM. To ensure trouble-free power, Austin installs a 200-watt Astec power supply in the 386/33.

Its speed shows. The Austin is a fast machine, even though it didn't dominate the testing. Only a tenth of a second separated it from the fastest machines in PC Labs benchmark processor tests.

With an as-tested price of $6,995, the Austin was one of the least-expensive machines in the roundup. Even in the rarefied climes of "price is no object" business computing, its Mitsubishi Professional VGA monitor, 16-bit SOTA VGA adapter, and CDC 155MB ESDI hard disk make the Austin a respectable choice in a networking or CAD environment.

The Austin's strengths—top-notch components, solid performance, terrific support, and a low price—make it a machine that dollar for dollar is hard to beat. Despite its concession to steam-age computing in the form of those quaint DIP switches, Austin buyers will not feel as if they had to settle. In fact, they may feel something else: the satisfaction of having made a sensible decision.

BOSS TECHNOLOGY

Boss 386 3633

by M. David Stone

In most ways, Boss Technology's 386 3633 is a run-of-the-mill 33-MHz 386 system (if any 33-MHz system can be called run-of-the-mill). But it manages to stand out in at least one respect: remarkably good disk performance. That alone makes the Boss 386 3633 worth some attention.

Prices on the Boss 386 3633 are definitely not bargain basement. The basic configuration—with 1MB RAM, one 1.2MB or 1.44MB floppy drive, parallel port, serial port, 40MB hard disk, Distributed Processing Technology (DPT) SmartCache Caching Disk controller, DOS 3.3, and no video—lists for $4,995. The *PC Magazine* standard configuration, with 4MB RAM, a 120MB hard disk, and 16-bit VGA card (but lacking a monitor and the 80837 coprocessor) was $7,999.

MIDRANGE TO IMPRESSIVE

Although there was relatively little difference among these machines in PC Labs' processor and memory benchmark tests, the Boss 386 3633 performed solidly in the midrange. But on the screen-update tests, where differences were significant, it was one of the fastest performers in two of the three video tests.

In the hard disk tests, the Boss 386 3633 was also among the best performers, tying for first place in one test and coming in second on another. The lightning-fast disk performance resulted partly from the



The Boss 386 3633 offers fast hard disk performance with its DPT SmartCache Caching Disk controller. With 4MB RAM, a 120MB hard disk, and a VGA adapter, the Boss lists for $7,999.

FACT FILE

Boss 386 3633
Boss Technology, 6050 McDonough Drive, Norcross, GA 30093; (404) 840-0886.
List Price: With 1MB RAM, 40MB hard disk, DPT SmartCache caching disk controller, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, DOS 3.3, $4,995; with 4MB RAM, 120MB hard disk, 16-bit VGA adapter, $7,999.
In Short: The Boss 386 3633 is notable for its fast disk performance, a benefit of its DPT SmartCache caching disk controller. Be aware, however, that the drive bay configuration—two half-height 5.25-inch bays, one full-height 5.25-inch bay, and two 3.5-inch half-height bays—may prove limiting. No monitor or 80387 is available from Boss Technology.

CIRCLE 400 ON READER SERVICE CARD

33-MHZ 386-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

TESTED CONFIGURATION	PC Brand 386/33 Cache	V.I.P.C.-33 386	Polywell Polysystem 33 Cache	Austin 386/33	Bus 386/33	Tangent Model 333
Disk controller manufacturer and type (interface/encoding)	Adaptec (ESDI)	Konan Technologies (ST-506/MFM)	Adaptec (ESDI)	Western Digital (ESDI)	Distributed Processing Technology (ESDI)	Western Digital (ESDI)
Number of drives handled by controller	4	4	4	4	6	4
BIOS version and date	Phoenix BIOS, Version 1.10.10 (January 1988)	Phoenix BIOS, Version 1.10.07 (1988)	Phoenix BIOS, Version 1.10.08 (June 1989)	Award BIOS, Version 3.04 (May 1989)	Phoenix BIOS, Version 1.10.10 (1989)	AMI BIOS, Version 3.11 (February 1989)
System board manufacturer	Micronics	Micronics	Mylex	Micronics	Micronics	AMI
386 chip set manufacturer	None (uses discrete logic)	None (uses discrete logic)	Chips and Technologies	Chips and Technologies	None (uses discrete logic)	Chips and Technologies
MEMORY SPECIFICATIONS						
Memory chip type	256Kb, 1Mb	256Kb, 1Mb	1Mb	256Kb, 1Mb	256Kb, 1Mb	1Mb
Chip packaging	DIP or SIMM	DIP	SIMM	SIMM	DIP	DIP
RAM chips	DRAM	DRAM	SRAM	DRAM, SRAM	SRAM	DRAM
Interleaved memory	❑	■	❑	■	❑	■
Shadow RAM	■	■	■	■	■	■
Disk cache software	■	■	❑	■	■	❑
Maximum RAM on motherboard	None	16MB	None	8MB	16MB	8MB
Maximum 32-bit RAM	64MB	32MB	32MB	16MB	16MB	16MB
Maximum total system RAM	64MB	32MB	32MB	32MB	16MB	16MB
PROCESSOR RAM CACHE						
Cache size:						
Minimum	32K	32K	64K	32K	32K	64K
Maximum	64K	64K	128K	64K	64K	64K
Installed	64K	32K	128K	64K	64K	64K
Cache memory speed	25 ns.	25 ns.	25 ns.	25 ns.	25 ns.	15 ns.
Cache controller	Intel 82385	Intel 82385	Discrete	Intel 82385	Discrete	Discrete
OTHER						
Warranty	5 years	1 year	1 year; 2 years on motherboard	1 year on-site	2 years; 1 year on-site service	1 year on-site service
FCC certification class	A	B	A	A	B	A
Password security	❑	■	❑	❑	❑	❑

—Editor's Choice ■—Yes ❑—No

16-millisecond Priam 120MB hard disk in the review system, but owed far more to the DPT Caching Disk controller. The DPT unit has on-board memory for caching, built-in caching algorithms, and a 68000 microprocessor for handling caching functions independently. This lets the board read from or write to the disk at the same time that the computer is reading from or writing to the cache.

The Boss 386 3633 uses an AMI motherboard, equipped with the Chips and Technologies chip set and AMI BIOS. Also on-board was 4MB of 70-nanosecond DIP-type DRAMs. The board allows for up to 4MB more in four SIMM sockets, with a current maximum for the system of 16MB—8MB on the system board and 8MB on the 32-bit memory board. The tested machine had an 80387-33 coprocessor; also helping performance is 64K of 20-ns. static RAM cache.

The motherboard has eight slots: one 8-bit, six 16-bit, and one 32-bit. The review system had three filled: disk controller, VGA card, and a serial/parallel card. A 9-pin serial port is located on the board itself, and a 25-pin RS232 is attached by ribbon cable. The extra connector does not tie up a system slot, using one of the eight nearby connector-size cutouts instead.

The front panel of the computer's tower case sports a keylock, the power-on switch, a safely recessed reset button, indicator lights for power and hard disk, an LED indicator showing the current system

FiveStar System 33/D	Amax PC/386-33	Wedge Cache WT386-33C	Northgate Elegance 386/33	Boss 386 3633	Tri-Star Flash Cache 386[33]	BSM Identity 386-33	Dyna 33Series
DPT (ESDI)	Future Domain (SCSI)	Western Digital (ESDI)	Adaptec (ESDI)	DPT (ESDI)	Western Digital (ESDI)	Data Tech. Corp. (ESDI)	Western Digital (ESDI)
4	7	4	4	4	4	2	4
Award BIOS, Version 3.04 (June 1988)	Phoenix BIOS, Version 1.10 10 (May 1989)	AMI 386 BIOS, Version DAMI 3607 (April 1989)	AMI BIOS, Version 3.11 (February 1989)	AMI BIOS, Version 3.0 (February 1988)	AMI BIOS, Version DAMI 3607 (April 1989)	AMI BIOS, Version 3601 (September 1988)	AMI BIOS, customized version (February 1989)
Micronics	Micronics	AMI	Northgate	AMI	AMI	Mylex	AMI
None (uses discrete logic)	Chips and Technologies	Wedge	Northgate	Chips and Technologies	None (uses discrete logic)	None (uses discrete logic)	Chips and Technologies
256Kb, 1Mb	256Kb, 1Mb	256Kb, 1Mb	1Mb	1Mb	1Mb	1Mb	1Mb
DIP	DIP	DIP or SIMM	SIMM	DIP	DIP	SIMM	DIP
DRAM	DRAM	DRAM	DRAM	DRAM	DRAM	DRAM	DRAM
❑	■	■	❑	❑	■	■	■
■	■	■	❑	■	■	■	■
■	❑	❑	■	❑	❑	❑	❑
None	None	8MB	8MB	8MB	8MB	None	32MB
16MB	16MB	16MB	16MB	8MB	16MB	32MB	64MB
16MB	16MB	16MB	16MB	16MB	16MB	32MB	64MB
32K	32K	64K	64K	64K	64K	0K	64K
32K	64K	64K	256K	64K	64K	128K	64K
32K	64K	64K	64K	64K	64K	128K	64K
25 ns.	35 ns.	20 ns.	25 ns.	20 ns.	20 ns.	25 ns.	20 ns.
Intel 82385	Intel 82385	Discrete	Discrete	Discrete	Discrete	Discrete	Discrete
1 year on-site	1 year	1 year	1 year on-site	1 year	1 year; 2 years on motherboard	1 year	1 year
A	A	A	A	A	A	A	A
❑	❑	❑	❑	❑	❑	❑	❑

CONTINUES

speed, and a nonfunctional turbo switch.

A possible drawback to this system is the arrangement of its five drive bays: two half-height 3.5-inch bays, two half-height 5.25-inch bays, and one full-height 5.25-inch bay. Be aware that the half-height 5.25-inch bays are vertical, making them unsuitable for some hard disks. In short, this is not the machine to get if you think you might eventually need three floppies, a tape drive, and two 650MB hard disks. Be aware also that, as of this writing, Boss Technology has not made provision for on-site service, though the company is currently working on it.

All told, the Boss 386 3633 has more going for it than against it, but the drawbacks are bothersome. You'll want to confirm that on-site service is available before buying. And you'll want to carefully consider how many drive bays you may eventually need. If the answer is not many, you're likely to be happy with the Boss system's performance.

BSM COMPUTERS

BSM Identity 386-33

by Alfred Poor

The BSM Identity 386-33 comes with a sticker price of just one thin dollar under five big ones: $4,999 for a 2MB RAM system with a keyboard, case, and DOS, but no disk controller or disk drives of any sort.

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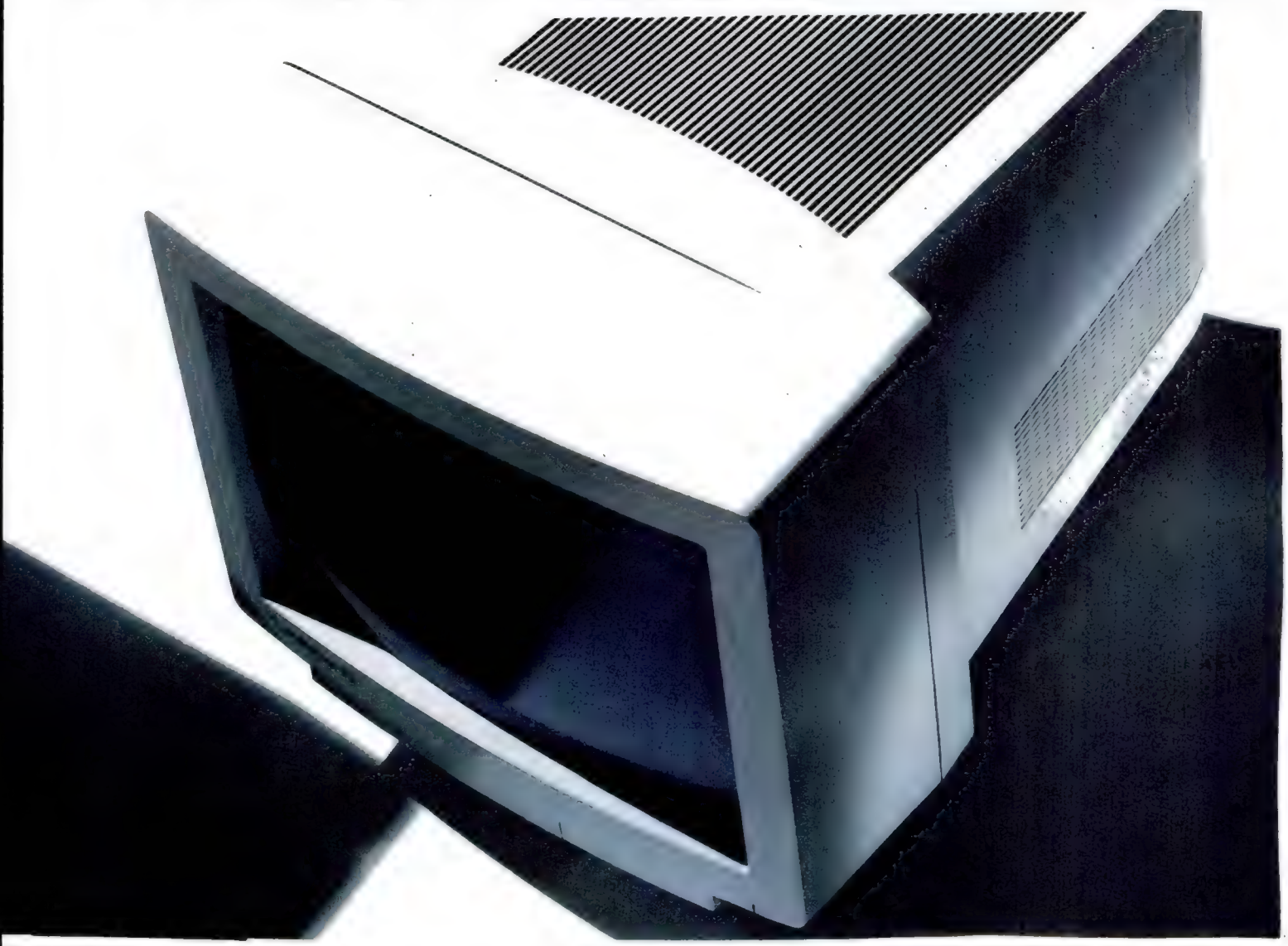
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NEC

CIRCLE 153 ON READER SERVICE CARD

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

TESTED CONFIGURATION	Gateway 386-33 Dream Machine	Micro Express 386-33	PC Link 386-33	Everex Step 386/33	AST Premium 386/33	Zenith Z-386/33
Disk controller manufacturer and type (interface/encoding)	Western Digital (ESDI)	Data Technology Corp. (ESDI)	Adaptec (ESDI)	Data Technology Corp. (ESDI)	AST (AT adapter)	DTC (ESDI)
Number of drives handled by controller	4	4	4	4	3	4
BIOS version and date	AMI BIOS, Version 1.10 10 (June 1989)	AMI BIOS, Version 3.11 (February 1989)	Award BIOS, Version 3.03.17 (May 1989)	AMI BIOS, Version FIS-28 (March 1989)	AST BIOS, Version 1.00 (May 1989)	Zenith BIOS, Version 2.8B (March 1989)
System board manufacturer	AMI	AMI	Hauppauge Comp.	Everex	AST	Zenith
386 chip set manufacturer	Chips and Technologies	Chips and Technologies	Chips and Technologies	None (uses discrete logic)	Chips and Technologies	Zenith
MEMORY SPECIFICATIONS						
Memory chip type	1Mb	256Kb, 1Mb, 4Mb	256Kb	1Mb	256Kb	1Mb, 4Mb
Chip packaging	DIP	DIP or SIMM	DIP	SIMM	SIMM	SIMM
RAM chips	DRAM	DRAM, SRAM	DRAM	DRAM	DRAM	DRAM
Interleaved memory	■	■	■	❑	❑	❑
Shadow RAM	■	■	■	■	■	■
Disk cache software	❑	❑	■	■	■	■
Maximum RAM on motherboard	32MB	8MB	4MB	16MB	None	32MB
Maximum 32-bit RAM	64MB	16MB	64MB	16MB	36MB	32MB
Maximum total system RAM	64MB	16MB	64MB	16MB	36MB	64MB
PROCESSOR RAM CACHE						
Cache size:						
Minimum	64K	64K	64K	64K	32K	16K
Maximum	64K	64K	64K	256K	32K	1MB
Installed	64K	64K	64K	128K	32K	16K
Cache memory speed	25 ns.	20 ns.	20 ns.	20 ns.	25 ns.	15 ns.
Cache controller	Discrete	Discrete	Intel 82385	Everex AMMA	Intel 82385	Zenith
OTHER						
Warranty	1 year	1 year; 4 months on-site service	1 year	1 year	1 year	3 months on-site parts and labor
FCC certification class	A	B	A	B	A	A
Password security	❑	❑	❑	❑	■	■

PC—Editor's Choice ■—Yes ❑—No

For a list price of $9,845, BSM Computers will build a model that meets our standard configuration: 4MB of RAM, 150MB ESDI hard disk, color VGA monitor, a 33-MHz 80387 coprocessor, and DOS 3.3 or 4.01.

But don't make out your check to BSM; the company won't sell you one. This is but one of the surprises that awaits you: you can't buy the Identity 386-33 from BSM since it does not sell directly, but only through dealers. This policy accounts in part for the relatively high list prices for these computers from a relatively unknown company, since more margin must be built into the list price for the dealer (if only to furnish a starting point from which to discount).

But what else is there about the Identity 386-33 that you might identify with at these prices? The components are solid though typical selections. There is a Data Technology Corp. (DTC) combination hard/floppy disk controller, along with a 150MB Micropolis full-height hard disk. The display system pairs a Western Digital/Paradise 16-bit VGA card with an impressive Mitsubishi Diamond Scan multifrequency monitor. The keyboard is a respectable Key Tronic 101-key model.

The tower case reviewed is a standard clone case with cross-bracing support but no ventilation except for the fan on the power supply. The motherboard is by Mylex, which is less frequently seen than those from some other companies such as

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	ALR FlexCache 33/386	Compaq Deskpro 386/33
	Adaptec (ESDI)	Compaq (ESDI)
	4	2
	Phoenix BIOS, Version 1.10 10 (January 1989)	Compaq BIOS, Version B.2 Fam. 386L (May 1989)
	ALR	Compaq
	None (uses discrete logic)	Compaq
	256Kb	1Mb
	SIMM	Custom modules
	DRAM	DRAM
	❑	■
	■	■
	■	■
	16MB	None
	16MB	16MB
	16MB	16MB
	128K	64K
	128K	64K
	128K	64K
	25 ns.	25 ns.
	Intel 82385	Intel 82385
	1 year	1 year
	A	B
	❑	■

ENDS



The BSM Identity 386-33 comes complete with 4MB RAM, a 150MB ESDI hard disk, a 1.2MB floppy disk drive, VGA, an 80387 coprocessor, and BSM's own discrete cache for $9,845.

FACT FILE

BSM Identity 386-33
BSM Computers, 1355 Glenville, Richardson, TX 75081; (214) 699-8300.
List Price: With 2MB RAM, DOS 3.3 or 4.01, $4,999; with 4MB RAM, 150MB ESDI hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, 80387-33 coprocessor, $9,845; with 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, 16-bit VGA adapter, multiscanning monitor, 80387-25 coprocessor, $9,999.
In Short: BSM computers are not sold directly but only through dealers. The Identity 386-33 maintains midrange performance and conventional design at an average price.

CIRCLE 401 ON READER SERVICE CARD

Micronics, but uses the popular AMI BIOS. Memory comes in 80-nanosecond SIMMs, and you can fit 8MB of 32-bit RAM into the system. When 4-megabit SIMMs become available, the system will be able to accept 32MB total.

SOME DISTINCTION

There are a few small design features that help set the Identity 386-33 apart from the field. Like some other 33-MHz 386s, it can run a math coprocessor asynchronously, which means that you can put in an 80387 chip rated at 25 MHz and still run the processor at a full 33 MHz. You can also change the crystal that controls the expansion card bus timing: it comes with a 16-MHz crystal standard for 8-MHz operation. According to a BSM representative, the motherboard is engineered for a bus speed as fast as 16 MHz.

Another interesting feature is that the Identity 386-33 uses a Dallas clock chip that has a battery built into the chip and is designed to last about 10 years.

In the end, however, there turns out to be little that sets the BSM apart from the crowd. The design is by and large similar to that of other clones and is reflected in its performance. The main reason to buy the Identity would be getting a good deal from a local dealer or value-added reseller who will also give you significant support or other services. You probably won't go wrong with the BSM Identity 386-33, but I can't suggest that you go out of your way to find one.

BUS COMPUTER SYSTEMS INC.

Bus 386/33

by Catherine D. Miller

The Bus 386/33 system from Bus Computer Systems is built with the best components available. That's why the company is confident enough to offer such a great warranty program: 2 years parts and labor and 1 year of on-site support.

In its $3,799 basic configuration, the Bus 386/33 comes in a tower case that houses seven half-height drive bays. Packed into the case are 1MB RAM, one 1.2MB floppy disk drive, a Western Digital hard/floppy disk controller, 80MB hard disk, a monochrome graphics monitor, one serial and one parallel port, DOS 4.01, and *VOpt*, a disk optimizer. The *PC Magazine* standard configuration came in at only $6,725.

Based around the Micronics 80386/33-MHz system motherboard, the Bus 386/33 has one 32-bit, five 16-bit, and two 8-bit slots. All system RAM is contained on a high-speed memory card that fits into the 32-bit slot for 1MB to 16MB of 32-bit system RAM. Standard on the system board is the Intel 82385 controlling a 32K direct map cache. By adding an optional four 8-kilobit by 8-bit 25-nanosecond SRAMs, you get 64K of two-way set-associative cache.

Microprocessor speed is software-switchable from 33 MHz at zero wait states to either 6 MHz or 8 MHz. Bus speed can be changed from the 11-MHz default to 8.25 MHz by setting a DIP switch on the board. A 33-MHz 80387 coprocessor was included in our evaluation unit.

GENERALLY SOLID SCORES

An additional 32K of 25-ns. cache brought the total cache size to 64K. Oddly enough,

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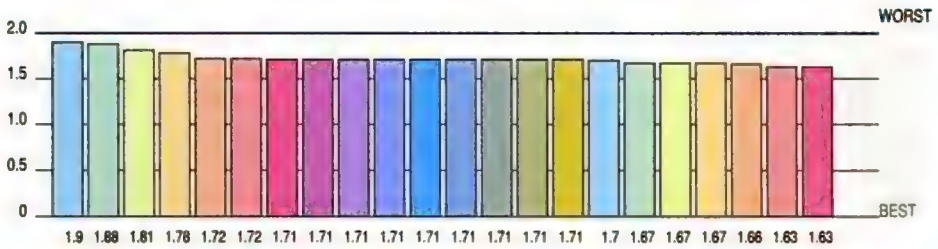
PC LABS BENCHMARK TESTS: 33-MHz 386-BASED PCs

Across the board one machine appears among the leaders of every test category, the Editor's Choice Compaq Deskpro 386/33, whose combination of processor, hard disk, and video performance is second to none. The computers from Northgate (our other Editor's Choice), ALR, and Everex rounded out the top of the class, with several others not far behind on many tests.

PROCESSOR AND MEMORY BENCHMARK TESTS

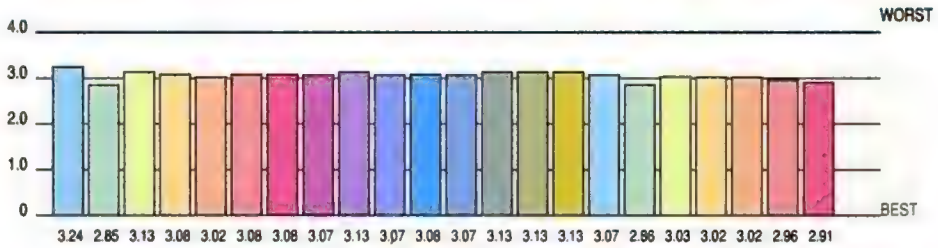
80386 Instruction Mix — Elapsed Time (seconds)

The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



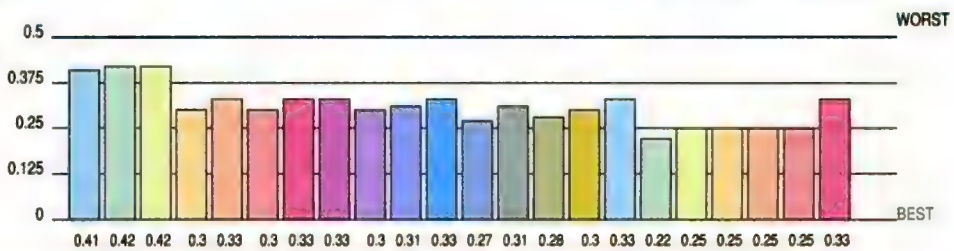
Floating-Point Calculation Without Coprocessor — Elapsed Time (seconds)

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory — Elapsed Time (seconds)

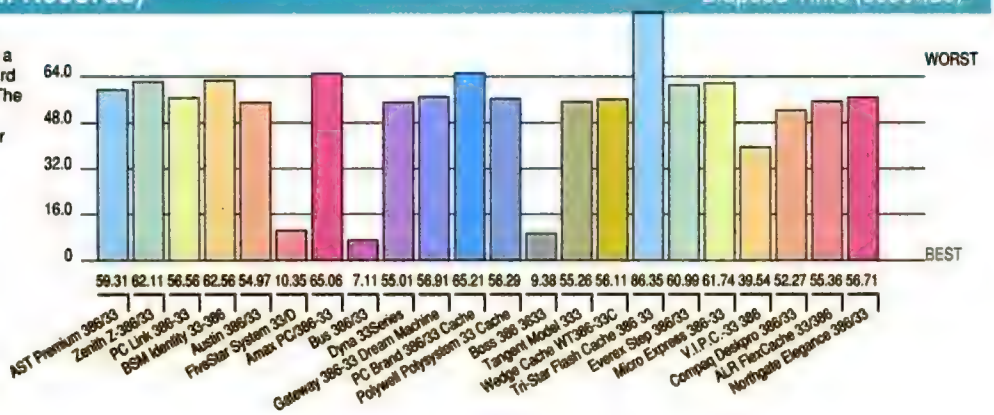
The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



DISK BENCHMARK TESTS

DOS File Access (Small Records) — Elapsed Time (seconds)

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



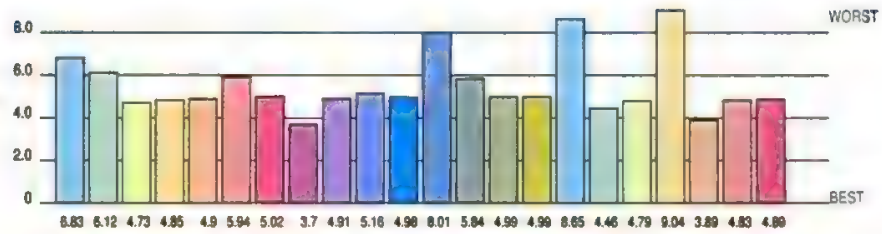
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BENCHMARK TESTS: 33-MHz 386-BASED PCs

DOS File Access (Large Records)

Elapsed Time (seconds)

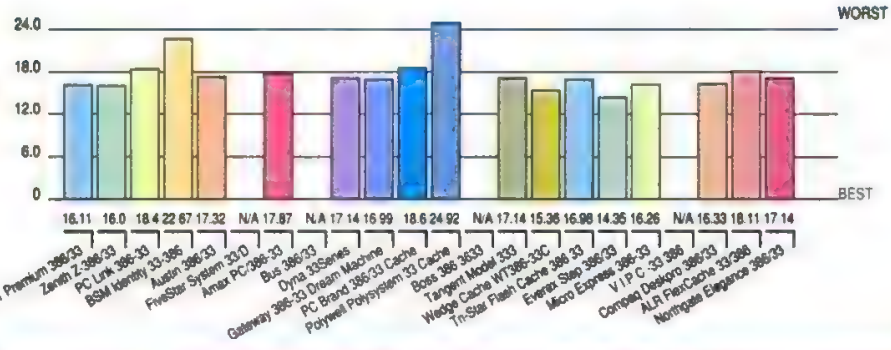
The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



BIOS Disk Seek

Elapsed Time (milliseconds)

The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.



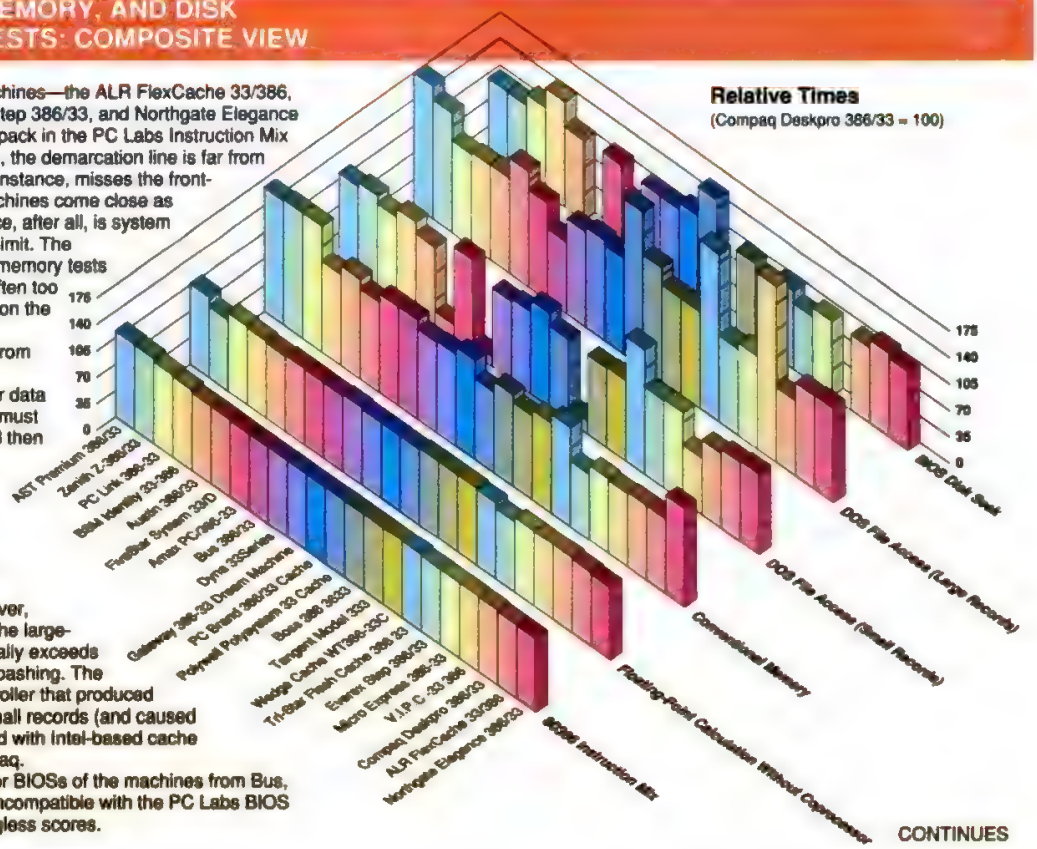
N/A—Not applicable: this machine's hard disk BIOS was incompatible with this test.

PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

Although four 33-MHz machines—the ALR FlexCache 33/386, Compaq Deskpro 386/33, Everex Step 386/33, and Northgate Elegance 386/33—clearly stood out from the pack in the PC Labs Instruction Mix and Floating-Point Calculation tests, the demarcation line is far from clear-cut. The Zenith Z-386/33, for instance, misses the front-runners by a slim margin; other machines come close as well. At the core of their performance, after all, is system architecture pushed virtually to the limit. The differences that our processor and memory tests show among these machines are often too small to help you evaluate any one on the basis of a single result.

More differences are apparent from the hard disk test results. While a mechanically faster disk will transfer data faster, your data, once off the disk, must contend with the controller card and then with the computer's bus—both of which will affect throughput. The FiveStar System 33/D, Boss 386 3633, and Bus 386/33 use a DPT SmartCache Caching Disk controller card with on-board cache for blazing small-record DOS File Access results. This caching, however, proved only marginally effective in the large-record test, where record size typically exceeds the cache limits, resulting in cache bashing. The V.I.P.C.-33 386 uses a Konan controller that produced only a marginal improvement for small records (and caused disaster for large records) compared with Intel-based cache controllers like the one in the Compaq.

Note that the hard disk controller BIOSs of the machines from Bus, FiveStar, Boss, and V.I.P.C. were incompatible with the PC Labs BIOS Disk Seek test, resulting in meaningless scores.



CONTINUES

BENCHMARK TESTS: 33-MHz 386-BASED PCs

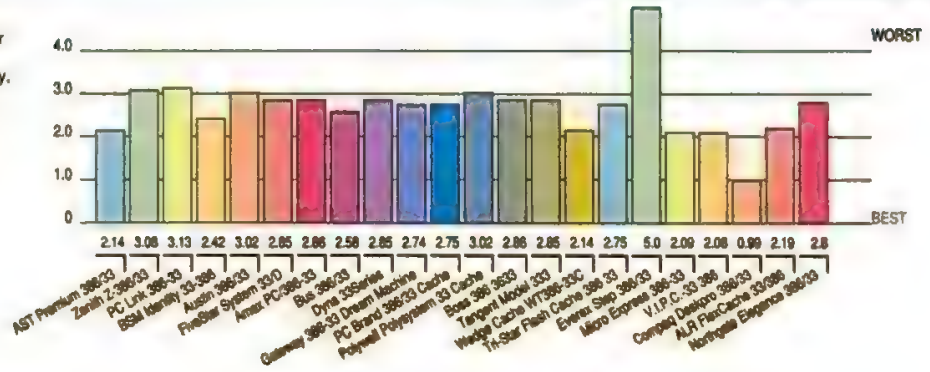
While video results are usually the least revealing of the test numbers, here they demonstrate that PC architecture may be as important in the 33-MHz environment as the high-performance I/O boards themselves. Witness the Compaq's video scores—which PC Labs took several times over before believing them. No other computer even came close here.

VIDEO BENCHMARK TESTS

Direct to Screen

Elapsed Time (seconds)

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.





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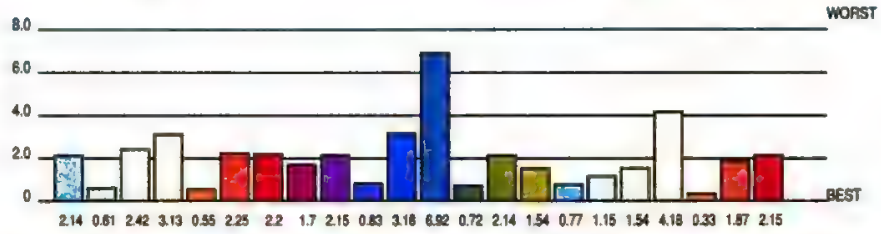
CIRCLE 504 ON READER SERVICE CARD

BENCHMARK TESTS: 33-MHz 386-BASED PCs

Video BIOS Routine Without Scrolling

Elapsed Time (seconds)

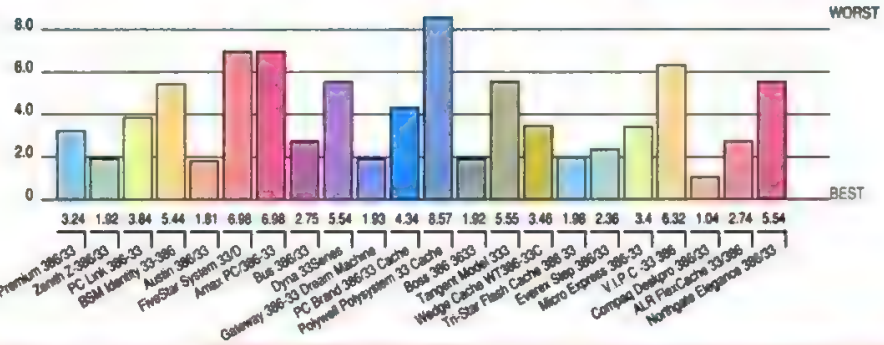
The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.



Video BIOS Routine with Scrolling

Elapsed Time (seconds)

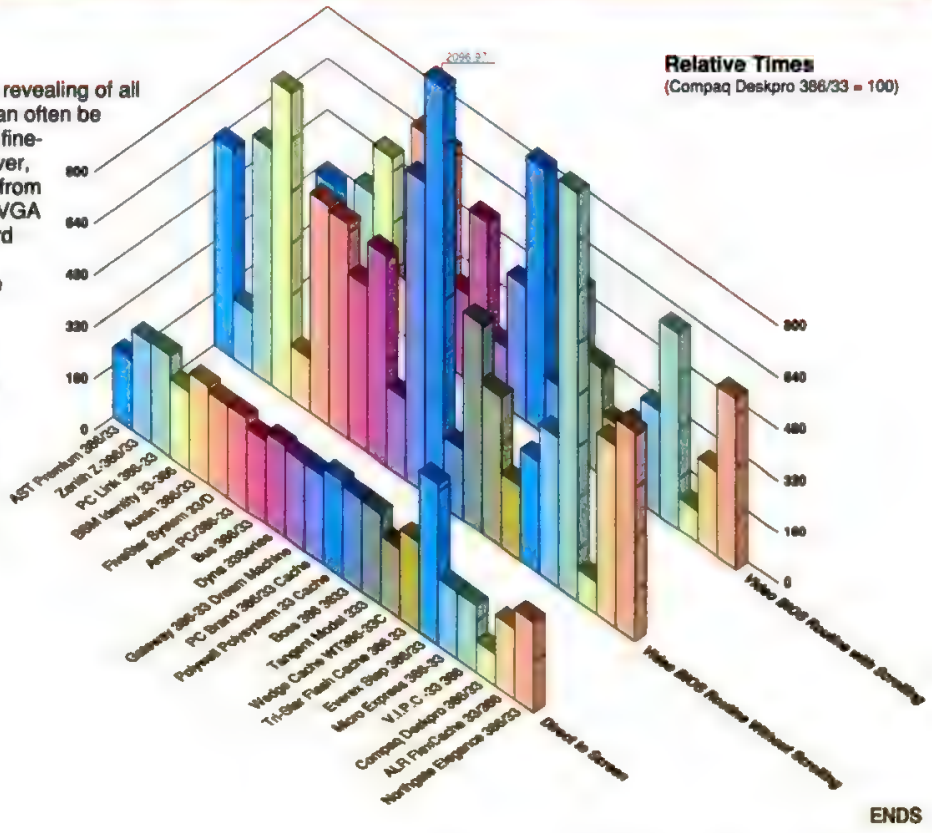
The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.



VIDEO BENCHMARK TESTS: COMPOSITE VIEW

Ordinarily, video test results are the least revealing of all numbers because different video cards can often be swapped into and out of any computer to fine-tune the video response. PC Labs, however, removed the ill-performing V-RAM board from the Polywell and substituted Northgate's VGA card—only to find that the Northgate board also performed poorly in the Polywell, compared with its results in the Northgate Elegance.

Though hardly comprehensive, the video test results suggest that machine architecture is becoming as important as the high-performance I/O boards themselves in the 33-MHz environment. One look at the Compaq's results would seem to reinforce this supposition, since its integrated video circuitry and unstoppable video BIOS shadowing ran the PC Labs video tests so fast it caused one of the testers to remark that if they blinked, they would have missed the test entirely!



the Bus 386/33 was slightly slower on the PC Labs processor and memory benchmark tests than were other machines, such as the V.I.P.C.-33 386, which used the same Micronics system board but didn't add the additional 32K cache memory. Still, the Bus 386/33 turned in a solid performance on these tests.

What the Bus 386/33 lacks in processor and memory test timings, it makes up for with its blazing speed in the PC Labs suite of disk benchmark tests. Garnering the fastest performances has a lot to do with the inclusion of the DPT SmartCache Caching Disk controller. The SmartCache supplied a whopping 4.5MB RAM to cache disk read and write operations from and to the fast 19-millisecond 380MB Micropolis ESDI drive, and brought the tested unit's price to $11,000.

This incredible caching disk controller first came to our attention when we tested Bus's 16-MHz, 20-MHz, and 25-MHz machines for our May 30, 1989, issue focusing on 386 computers (see the sidebar "Hard Disk Speed: The Cache Advantage," *PC Magazine*, May 30, 1989, page 294). Since this controller's speed is affected by processor speed, it sizzles in a 33-MHz 386 computer.

ATI's 16-bit VGA Wonder card and NEC's MultiSync 3D monitor supplied our evaluation unit with quality graphics. The Bus 386/33 turned in competent times in all three video benchmark tests.

While all the components in our evaluation unit were top-notch, the most unique item was the keyboard. Bus has commissioned a keyboard manufacturer to produce a keyboard of Bus's own design. Can't decide if you like function keys across the top of the keyboard or on the left side? This keyboard, which comes standard with the 386/33, has both, plus a comma in the numeric keypad.



The Bus 386/33 in our standard configuration gives you 4MB RAM, a 120MB hard disk, VGA, and an 80387 coprocessor for only $6,725, including a 2-year warranty with 1 year of on-site service.

The advantages of using a machine like this as a LAN file server or as a dedicated system for disk- and processor-intensive tasks are readily apparent: vast storage capacity, an exceptionally speedy disk controller, and solid 33-MHz 386 performance. The generous warranty makes it even more attractive.

FACT FILE

Bus 386/33
Bus Computer Systems Inc., 135 W. 26th St., 8th floor, New York, NY 10001; (800) 451-5279, (212) 627-4485.
List Price: With 1MB RAM, 80MB hard disk, 1.2MB 5.25-inch floppy disk drive, monochrome monitor, DOS 4.01, *VOpt* disk optimizer, $3,799; with 4MB RAM, 120MB hard disk, VGA monitor, 80387-33 coprocessor, $6,725; with 380MB hard disk, DPT SmartCache Caching Disk controller with 4MB cache, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, 80387-33 coprocessor, tower case, $11,000.
In Short: The Bus 386/33 is loaded with quality components, including a Micronics motherboard. A fast Micropolis hard disk and DPT SmartCache caching disk controller give exceptional disk performance. Also, Bus offers a 2-year warranty with 1-year on-site service.

CIRCLE 402 ON READER SERVICE CARD

COMPAQ COMPUTER CORP.

Compaq Deskpro 386/33

by Robert W. Kane

A first glance at the Compaq Deskpro 386/33 with the large Advanced Graphics monitor perched on top would lead one to think that there was nothing new happening at Compaq. Designed in the same proportions as its small-footprint brethren, the big Compaq's facade now resembles that of the rest of Compaq's desktop product line. But don't be fooled—the Deskpro 386/33 is an engineering tour de force. Compaq has once again displayed its proficiency at building personal computers.

All this performance and expandability does come at a price. The base system starts at $11,198, while the standard configuration with 4MB RAM, a 320MB ESDI hard disk, VGA monitor, 33-MHz 80387 coprocessor, and DOS 4.01 lists for $18,746. The test unit was brimming with options at $25,017. And for that price you still don't get the tower option needed for floor-standing file servers.

The Deskpro 386/33 is all new, inside and out, with an emphasis on performance, design, and compatibility. The Compaq contains all the requisite hardware necessary for computing in a 33-MHz environment: 64K static RAM processor cache running at 25 nanoseconds, simultaneous support for both the 80387 and the Weitek 3167 coprocessors, 32-bit memory expansion up to 16MB, and up to 1.3 gigabytes of internal disk capacity. All this makes the 386/33 a versatile platform for today's power user.

While other companies chose to springboard their 33-MHz machines from existing designs, Compaq instead started from scratch to make what is probably its best PC to date. Every detail has been attended to in the Deskpro. Component placement is so well thought out that the unit was certified FCC B on its first submission. A 15-MHz ESDI disk controller flows data fast-

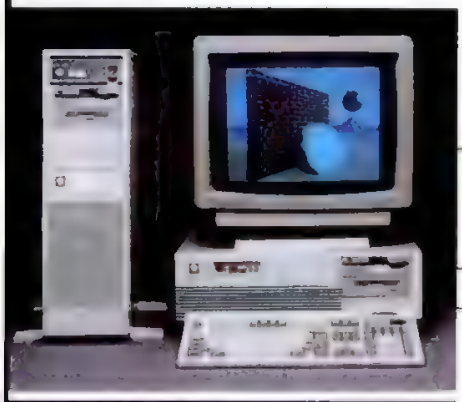
FACT FILE
EDITOR'S CHOICE

Compaq Deskpro 386/33
Compaq Computer Corp., 20444 FM 149, Houston, TX 77070; (713) 370-0670.
List Price: With 2MB RAM, 84MB hard disk, 1.2MB 5.25-inch floppy disk, VGA monitor, $11,198; with 4MB RAM, 320MB hard disk, VGA monitor, 80387-33 coprocessor, DOS 4.01, $18,746; with 150/250MB tape backup, 1.44MB 3.5-inch floppy disk drive, 2,400-bps internal modem, Advanced Graphics color monitor, Advanced Graphics 1024 controller, Advanced Graphics memory board (512K RAM video adapter memory upgrade), $25,017.
In Short: The Compaq Deskpro 386/33 is a showcase of the engineering prowess that has made it a leader in the 386 marketplace. Even with its premium price tag, it is the high-performance choice for CAD, networking, and multiuser applications, and for power users demanding the maximum in CPU performance.

CIRCLE 403 ON READER SERVICE CARD

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BASE SYSTEM	$3,039	$2,039	$3,099	$2,099	$3,509	$2,509	$3,709	$2,709
60MB DRIVE	$3,639	$2,639	$3,699	$2,699	$4,109	$3,109	$4,309	$3,309
108MB DRIVE	$3,989	$2,989	$4,049	$3,049	$4,459	$3,459	$4,659	$3,659
142 MB DRIVE	$4,289	$3,289	$4,349	$3,349	$4,759	$3,759	$4,959	$3,959



Standard Features: Genuine Intel 386 CPU · 1MB RAM Memory on Board 1.2MB Floppy Disk Drive · 2 Serial, 1 Parallel Port · 101-Style Enhanced Keyboard · Full-Size Desktop Case with 220W Power Supply

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BASE SYSTEM	$1,439	$1,139	$1,499	$1,199	$1,909	$1,609	$2,109	$1,809
60MB DRIVE	$2,039	$1,739	$2,099	$1,799	$2,509	$2,209	$2,709	$2,409
80MB DRIVE	$2,189	$1,889	$2,249	$1,949	$2,659	$2,359	$2,859	$2,559
108MB DRIVE	$2,389	$2,089	$2,449	$2,149	$2,859	$2,559	$3,059	$2,759



Standard Features: 512KB RAM Memory on Board · 1.2MB Floppy Disk Drive · 2 Serial, 1 Parallel Port · 101-Style Enhanced Keyboard · Jr. Full-Size Desktop Case · 200W Power Supply

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$768 PC MAX 286 BASIC SYSTEM **12MHz** (True 12MHz CPU)

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	16MHz	12Mhz	16MHz	12Mhz	16MHz	12Mhz	16MHz	12Mhz
BASE SYSTEM	$ 918	$ 768	$ 978	$ 828	$1,388	$1,238	$1,588	$1,438
20MB DRIVE	$1,178	$1,028	$1,238	$1,088	$1,648	$1,498	$1,848	$1,698
40MB DRIVE	$1,368	$1,218	$1,428	$1,278	$1,838	$1,688	$2,038	$1,888
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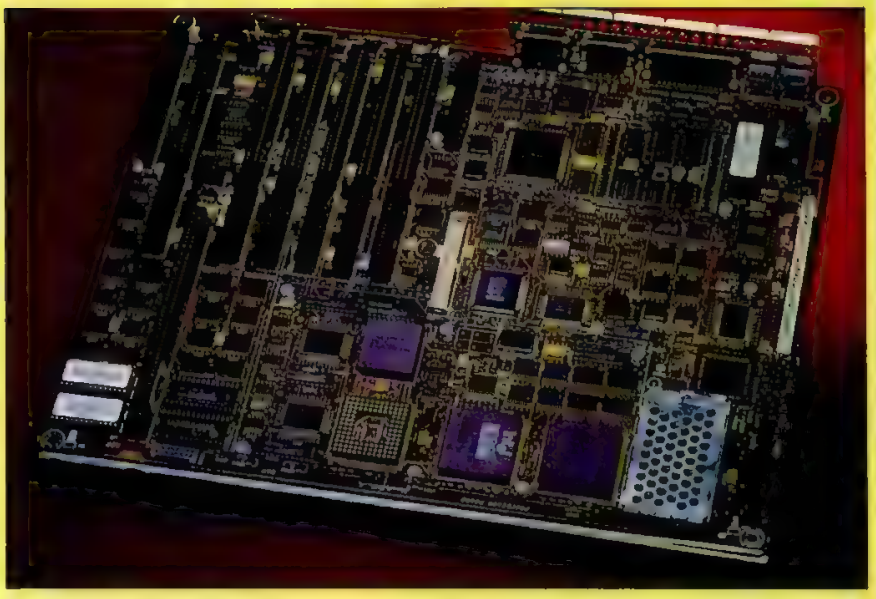
PC MAX

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CIRCLE 103 ON READER SERVICE CARD



The Compaq Deskpro 386/33 does not come cheaply: $18,746 for 4MB RAM, a 320MB hard disk, VGA, and an 80387 coprocessor. But for design excellence and overall performance, it is in a class by itself.



Even with its use of VLSI components, this Compaq 33MHz motherboard is still heavily populated with discrete integrated circuits. Carrying proprietary architecture to new levels, Compaq also includes a 15-MHz slot for its own hard disk controller card, 16-bit VGA circuitry on the motherboard, and simultaneous Weitek and 80387 coprocessing.

er than any other noncached PC in this roundup. An integrated 16-bit VGA controller employing multiplane video memory addressing puts text on the screen so fast that it will make your eyes roll back into your head. And the 300-watt power supply will keep the Deskpro running under the most arduous file-server applications.

REMEMBERING WHEN

Compaq has not forgotten what has made it the industry's leading manufacturer of Industry Standard Architecture (ISA) machines: compatibility. Being the first manufacturer to create a high-speed computer with the I/O bus decoupled from the memory bus, Compaq's FLEX architecture is once again put to use in the big Deskpro. This allows the Compaq to run any standard XT/AT expansion board.

In addition to the aforementioned integrated video controller, Compaq has also included floppy disk, hard disk, parallel, serial, mouse, and keyboard connectors on the motherboard, leaving the expansion bus open for other peripherals. The most curious of these interfaces is for the hard disk. Used only with the base 84MB drive, this controller is automatically disabled when the 15-MHz ESDI controller is installed for the 320MB and 650MB hard disk models. Since a machine of this caliber cries out for a high-performance, high-capacity disk system, the integrated controller will probably go to waste in most of the 33-MHz models Compaq sells.

Our test unit also came with the new Compaq Advanced Graphics system. Consisting of a high-resolution 15-inch color monitor and an Advanced Graphics board, this is Compaq's answer to IBM's 8514 display system for the MCA. Exploiting Texas Instruments' 34010 graphics coprocessor, it is capable of noninterlaced 1,024- by 768-pixel resolution and 256 simultaneous colors from a palette of 16.7 million. Currently shipping with drivers for *Microsoft Windows* and *AutoCAD*, this board is the perfect complement to the 386/33 for users with CAD and desktop publishing applications.

The Deskpro 386/33 is all new, inside and out, with emphasis on performance, design, and compatibility.

The Deskpro 386/33 is a testimony to the commitment Compaq has made to the combination of ISA and high-performance computers. If your computing needs demand the most in performance, compatibility, and expandability, the Deskpro deserves serious attention.

DYNA COMPUTERS INC.

Dyna 33Series

by Edward Mendelson

Dyna Computers' 33Series computer has a name that makes it sound as if it's two or three machines instead of one—and like all the machines in this roundup, it runs as fast as two or three ordinary computers put together.

Dyna will sell you a bare-bones 33-MHz system with no hard disk, video card, or monitor for $5,016. For that price, you get a tower case containing 4MB of 70-nanosecond motherboard RAM, 64K of 20-ns. processor cache memory, a

It takes guts to change a winner.



Introducing the new line of CompuAdd computers.

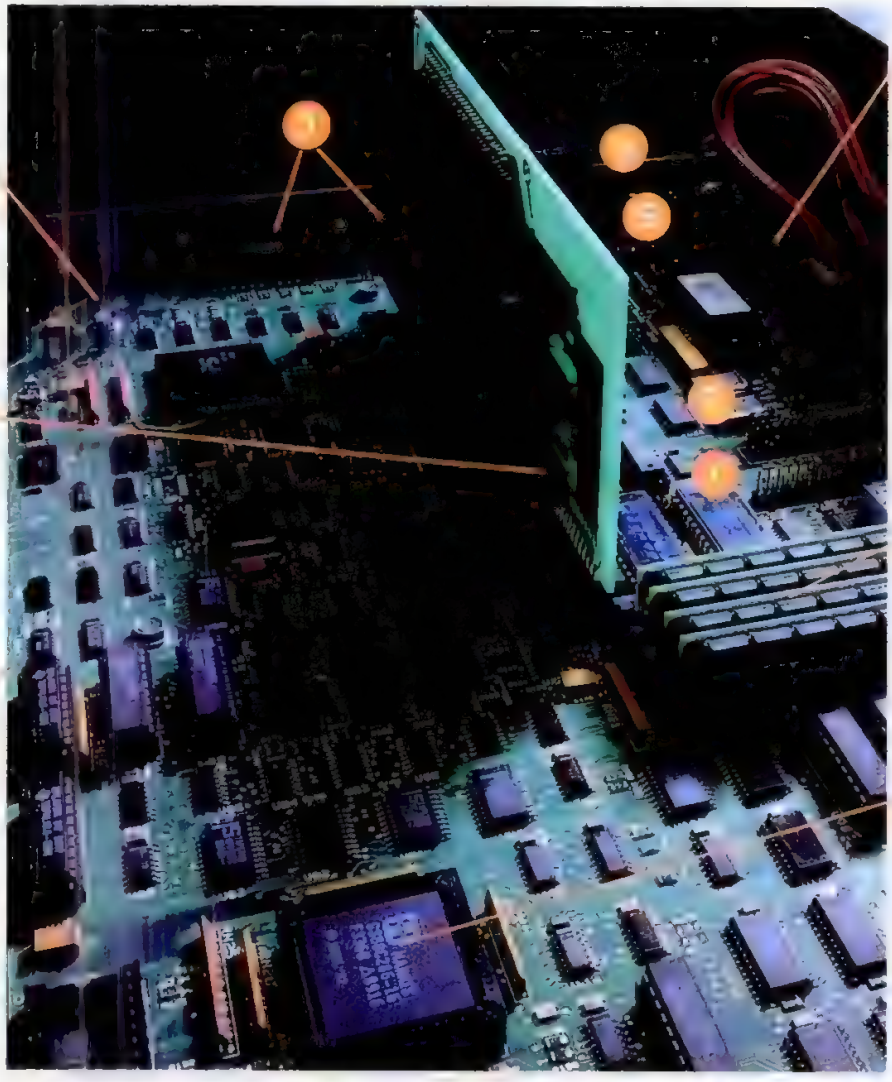
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Here's our guts.

Motherboard designed by CompuAdd's engineering design team from the ground up—to the most demanding standards.

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CompuAdd's 4-layer board requires greater design discipline than others' 6-layer boards, but reduces manufacturing costs, so we can sell to you for less.



Surface mount technology adds five full functions to the motherboard:

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5. *a game port interface.*

512K On-board memory is expandable to 4MB using Single In-Line Memory Modules (SIMMs).

Proven technology of the 80286 chip running at 16MHz.

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All components are high quality—specified by CompuAdd design engineers to our own board-level quality standards.

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You don't have to pay more to get everything you want. In fact, you can pay 35% to 45% less.

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As shown, with Color VGA monitor and 20MB hard drive, $1410.

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- Two half-size expansion slots.
- Built-in game port interface.
- 8087 math coprocessor support.
- 5.25" 360KB diskette drive.
- Optional real time clock.
- 101-key enhanced keyboard.
- 145 watt power supply.



CompuAdd 212, Only $895.

As shown, with Color VGA monitor and 20MB hard drive, $1799.

- 80286 processor running at 12MHz.
- 512KB RAM expandable to 4MB on motherboard.
- 0 wait state page-mode memory.
- Built-in dual IDE hard drive interface.
- Built-in dual diskette drive controller.
- Built-in parallel printer port.
- Two built-in serial ports.
- Five expansion slots: three full-size 16-bit and two half-size 8-bit.
- Built-in game port interface.
- 80287 math coprocessor support.
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive.
- Real time clock.
- 101-key enhanced keyboard.



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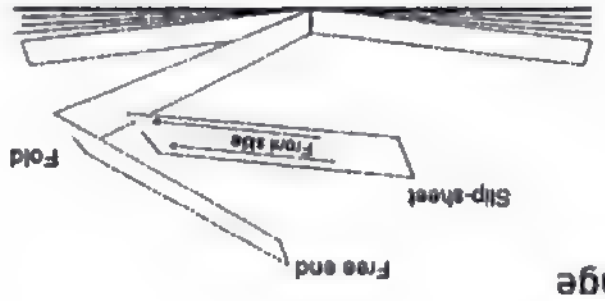
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GbsSlipSheet-001

Foldout slip-sheet

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2. Insert this sheet with
   1. Front side touching the free page
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4. Close the page and slip-sheet



Inverted Foldout slip-sheet

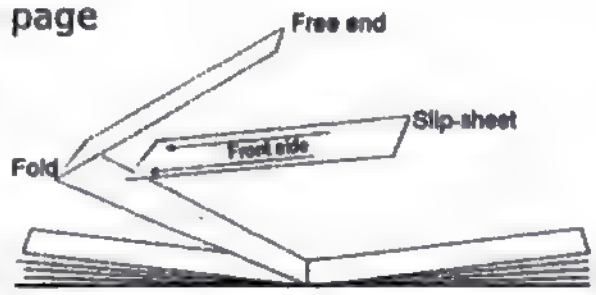
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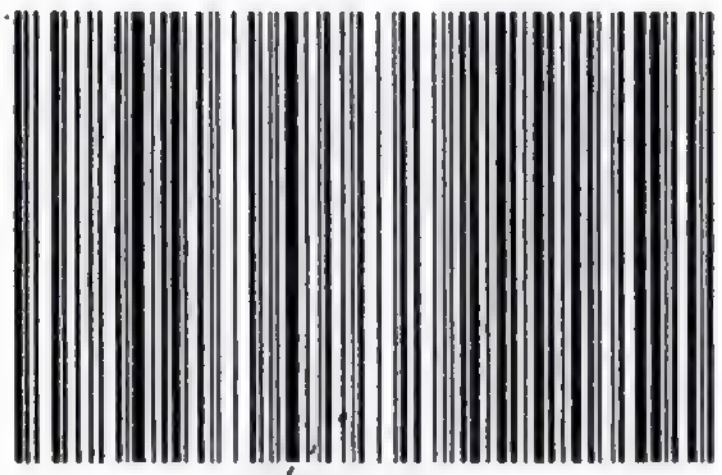
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Back

1. Follow instructions on the other side



ver the last few years, CompuAdd has taken its share of awards in the trade press, from "Editor's Choice" to "Best Buy." Despite that, we're changing our entire line. Because, no matter how good we get, we'll never stop looking for ways to improve.

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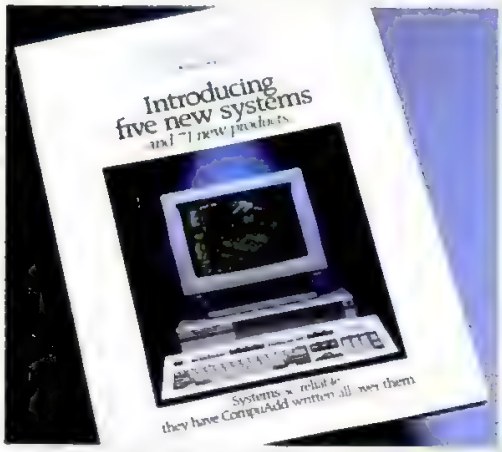
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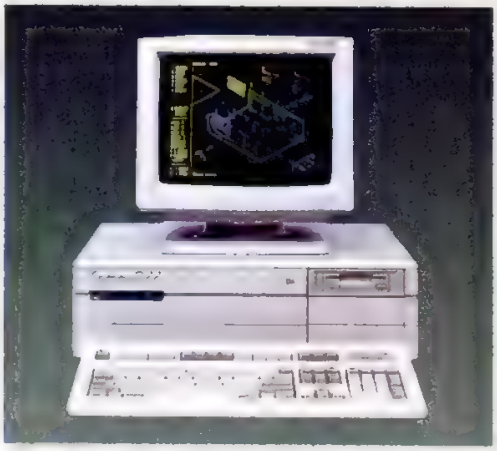
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Dyna's quality 33Series model with 4MB RAM, a 147MB hard disk, two floppy disk drives, VGA, and an 80387 coprocessor lists for $9,265. An extended warranty is available but probably unnecessary.

1.2MB floppy disk drive, a hard disk controller, DOS 3.3, and an 101-key keyboard made by Monterey Electronics. The $9,265 system tested by PC Labs added a 1.44MB floppy disk drive, and its CDC hard disk with a Western Digital ESDI controller had a capacity of 147MB. The math coprocessor runs at 33 MHz, and the VGA system was top quality: a Video Seven V-RAM VGA card and a Mitsubishi Diamond Scan multiscanning monitor. Dyna sent an exceptionally clear and detailed manual for an earlier model in its line and promises equally impressive documentation for the Dyna 33Series.

Dyna's sturdy tower case is a standard clone design with six accessible half-height drive bays and a front panel with a keyboard lock, a turbo switch that does nothing, and a reset switch that resets. The second serial port extends via a cable to one of the knockouts on the back panel, so you use only one expansion slot.

To get inside the case you have to pull off a plastic back panel, unscrew the large metal cover, and lift it off the frame. Inside, you'll find a motherboard with the AMI BIOS that is becoming one of the more popular choices for fast machines, and the usual set of one 32-bit slot, six 16-bit slots, and one 8-bit slot. The built-in setup program lets you shadow the video and system BIOS into RAM.

FACT FILE

Dyna 33Series
Dyna Computers Inc., 3081 N. First St., San Jose, CA 95134; (408) 943-0100.
List Price: With 4MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 3.3, $5,016; with 147MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, 80387-33 coprocessor, $9,265.
In Short: Dyna's 33-MHz machine uses nothing but luxury components for a reliable no-nonsense system. System performance is solidly in the middle range of 33-MHz machines, although the AMI motherboard includes some tweaking by Dyna for enhanced performance.

CIRCLE 407 ON READER SERVICE CARD

HUSHED-UP MOTHERBOARD

Since Dyna has customized the memory management and souped up the cache-control circuitry, it won't say who built the motherboard, but the board bears an uncannily exact resemblance to the AMI motherboards found on other 33-MHz machines in this survey. The only visible difference was a single jumper wire on the Dyna board. The Dyna 33Series is in the middle of the pack on the PC Labs benchmark tests, with scores similar to those of the other 33-MHz AMI-based PCs. The expansion bus speed is a sober 8 MHz, and any memory that the CPU doesn't get from the hardware cache is accessed via an interleaved memory scheme.

Currently the Dyna motherboard can hold 8MB of memory, half in DIP sockets; the rest are SIMMs. When 4-megabit chips become available, the motherboard will accommodate 32MB. An optional 32-bit memory card can hold 8MB of 1Mb DRAM chips now, 32MB of 4Mb chips in the future. The SIMM sockets, however, line up with the expansion slots and might conceivably conflict with excessively large add-in cards. Also, Dyna has but one coprocessor socket on the motherboard; the company will sell you a $250 daughtercard to let you install both a Weitek chip and an 80387.

Dyna offers 1 year of free parts and labor but lets you buy an extended warranty as an option. With the quality components inside—and provided that you buy one of the better hard disks Dyna offers—you'll probably forget about the warranty after you unpack this quality computer.

EVEREX COMPUTER SYSTEMS DIVISION

Everex Step 386/33

by Bruce Brown

Everything about Everex systems reflects the company's dedication to speed. The Step 386/33 gives you room for 16MB of 32-bit memory, up to 256K of cache memory, both 80387-33-MHz and Weitek 3167 math coprocessors, and space for two full-height, large-capacity hard disks. You can spend more for a 33-MHz computer, but you can't find a machine with a clearer dedication to pure speed.

The Step 386/33 uses a proprietary motherboard and 80386 chips with AMI's well-received system BIOS. The base system costs $6,199 and includes 1MB RAM, a 64K cache, a 1.2MB 5.25-inch floppy disk drive, parallel and serial ports, ESDI combination floppy/hard disk controller, and DOS 3.3. Our standard configuration with 4MB RAM, a 160MB hard disk, a 16-bit VGA card plus a Casper or Tatung VGA monitor, and an 80387-33-MHz coprocessor costs $11,342—a high-end price tag. The tested unit actually had a 330MB hard disk and lists for $12,591.

FACT FILE

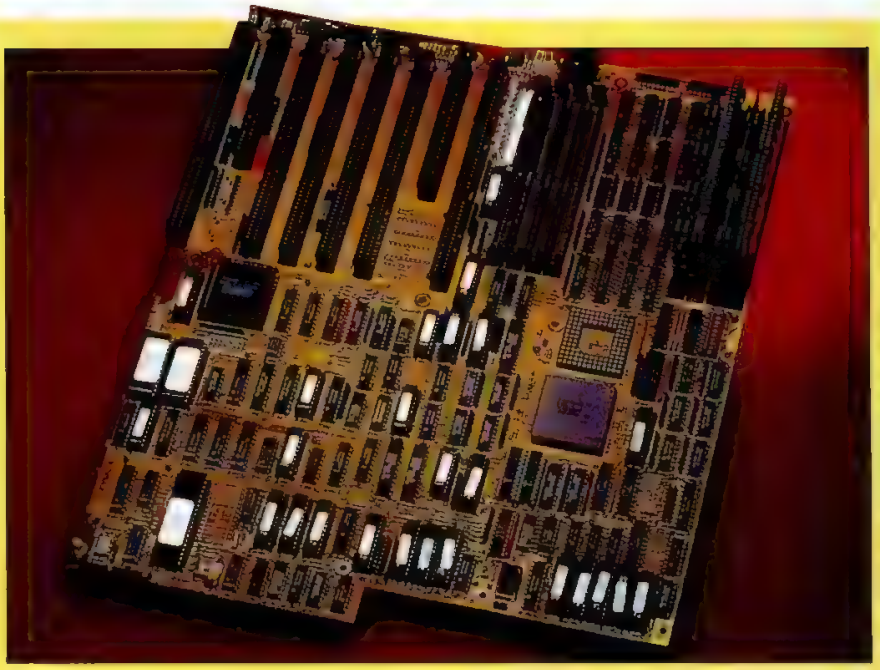
Everex Step 386/33
Everex Computer Systems Division, 48504 Kato Rd., Fremont, CA 94538; (800) 356-4283, (415) 498-1111.
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 3.3, $6,199; with 4MB RAM, 160MB hard disk, VGA monitor, 80387-33 coprocessor, $11,342; with 330MB hard disk, $12,591.
In Short: With the Step 386/33, Everex continues its tradition of extremely fast system design and component selection. Capable of holding two high-capacity full-height hard disks, the Step 386/33 offers excellent expansion possibilities.

CIRCLE 404 ON READER SERVICE CARD

The desktop case has indicator lights for power, disk access, and speed—the system lock and the speaker and system reset switches are all hidden behind a sliding smoked plastic door. The processor runs at 8.25, 16.5, or 33.3 MHz, with the latter being the specified upper limit for the Intel 80386 chip, consistent with the Everex reputation of designing the fastest PCs safely within processor design specs. The computer's expansion bus can run at a fast 11.6 MHz, switching to a default speed of



Lurking behind the smoked glass of the Everex Step 386/33 is 4MB RAM, a 160MB hard disk, 128K cache, and an 80387 coprocessor—all designed for maximum speed. With VGA the system is $11,342.



Everex's approach to motherboard design includes VLSI circuitry and a low discrete chip count. The result is a motherboard that offers fast performance. The numerous white-labeled ICs (integrated circuits) typically bespeak a manufacturer's reluctance to permit the general public (and competitors) to learn its chip source and type.

8.25 MHz to ensure compatibility.

The Everex motherboard is a totally jumper- and switch-free system. Configurations can be set from the keyboard using a ROM-resident setup program accessible with the Ctrl-Alt-F1 key sequence. The motherboard has four slots for main memory and four cache memory slots. Using 1-megabit SIMM chips on modules of either 1, 2, or 4MB, you can build the system to 1, 2, 3, 4, 6, 8, 12, or 16MB depending on module allocation. The only rule is that you must use the same size module in each memory slot. The processor RAM cache size depends on the number of main memory slots used, with 64K of cache memory per main memory slot filled. The 4MB test machine used two 2MB memory slots; therefore the machine accommodates 128K of cache memory.

TIME IS CACHE

The cache uses 20-nanosecond static RAM chips. Its scheme uses a proprietary design called AMMA, a scalable write-back cache that allows an effective zero-wait-state performance 96 to 99 percent of the time for memory reads but writes back only to the cache, saving time over designs that immediately write back to both main and cache memory. Main memory write-backs are made in bulk, freeing the processor from unnecessary duty. The Step 386/33's design obviously works since it was one of the fastest 33-MHz machines we tested, doing especially well on the processor and memory benchmark tests.

Since you don't need to use a slot to upgrade the memory, there are fully eight slots, two 8-bit and six 16-bit, for expansion opportunities. There's also room for two full-height hard drives (Everex sells a 330MB full-height drive for a maximum 660MB of storage) plus a floppy disk drive. If you prefer, you can opt for five half-height devices fed by the ample 200-watt power supply.

A new Step 386/33 owner's manual is an information-packed 309-page tome, complete with well-illustrated sections on configuration, operation, troubleshooting, MS-DOS, applications software, installing system options and upgrades, and utility software. A 101-key Maxi-Switch keyboard completes the system.

Plain and simple, the Everex Step 386/33 is a fast computer, and if speed is what you are looking for, consider the Everex along with the ALR, Compaq, and Northgate machines. Its engineering quality and breakneck performance put it at the front of the pack.

FIVESTAR COMPUTERS

FiveStar System 33/D

by Alfred Poor

The FiveStar System 33/D comes in a typical desktop case with a typical motherboard and other typical components. It also comes with a base price of $4,103 for a 1MB monochrome display model with a 60MB run-length limited (RLL) hard disk drive, or $8,298 for our standard 4MB color VGA configuration with a 150MB ESDI drive and DPT SmartCache Caching Disk controller, a 33-MHz 80387 coprocessor, and DOS 4.01.

Those prices are reasonable but not significant enough to distinguish this lesser-known company from its mail-order and clonemaker competition. One of the most substantial differences is the appearance of the documentation. Many low-end vendors simply stuff a bunch of component manuals into a plastic bag and call it documentation. When you open the FiveStar box, you'll find a handsome black vinyl binder with a silk-screened logo on the cover. Inside, there are half a dozen tabbed dividers for sections such as "Operations Guide" and "Storage Devices." Overall,



Now you can change programs on your computer just as easily.

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Actually, a lot of people tried. But what they ended with were a bunch of fancy software "environments" that eat up memory, change the way you work, and boggle the mind with complexity.

Plus, a lot of them make you buy new "compatible" software applications. Some even make you buy a bigger computer.

Software Carousel, on the other hand, works with the programs you already own. So you can go on using 1-2-3, WordPerfect, dBASE, SideKick, any program that runs on the computer you use right now. In an absolute minimum of memory. Without changing anything about the way your software runs.

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CIRCLE 150 ON READER SERVICE CARD

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it's competent documentation that looks better at first than it does under scrutiny, but proves to be sufficient.

The first section turns out to be less than 40 pages of general setup information, much of which is a glossary of terms. The remaining inch and a quarter of paper is simply the familiar component manuals with holes punched so they fit the binder.

The FiveStar does come with a handy set of utilities called *QA Plus* from Diag-Soft. This is a set of programs that can be used to identify and diagnose the components in your configuration. FiveStar also includes an on-site service contract through GE for the first year in addition to the traditional 1-year warranty.

FEW OTHER DIFFERENCES

From here on, however, the differences with other machines dwindle. The motherboard is the familiar Micronics design, featuring an Award BIOS for both the system and the keyboard. There is an Everex I/O card, with a parallel and two serial ports. The case has five half-height bays, three of which are open through the front panel for removable media. A 200-watt power supply has a full complement of five power connectors, so there is no prob-



FiveStar's System 33/D adds 1-year on-site service and a DPT SmartCache Caching Disk controller to our standard configuration of 4MB RAM, a 150MB ESDI hard disk, VGA, and an 80387 for $8,298 to make a competitive package.

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CIRCLE 266 ON READER SERVICE CARD

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UNWANTED EMISSIONS: EMI and RFI

by Winn L. Rosch

Ask an engineer for a quick definition of EMI and RFI, and chances are he'll call them both a headache. The two effects are welcome only in their absence, and minimizing them can be the most rigorous part of designing a new computer system.

Technically, EMI stands for electromagnetic interference; RFI, radio frequency interference. They are actually two aspects of the same phenomenon, and strictly speaking, EMI is a more general term that includes RFI. In fact, computer engineers generally refer to both simply as "emissions."

Both refer to stray signals that radiate from inside computers or just about any electrical device. RFI covers signals that interfere with radio (and television) transmissions; EMI signals can be any frequency but are usually restricted to lower-frequency signals (below 30 kHz) and aperiodic noise.

SOURCE OF EMISSIONS

Any flow of electrical current induces a magnetic field; similarly, a moving magnetic field induces a current. The field radiates outward—forever if unchecked, though generally losing strength as it moves away from its source. Any time a current flows through a wire, a magnetic field is generated. When such radiation is desired, the emanations are called radio waves, and the radiating wire, an antenna.

Inside your computer, every length of printed circuit foil and every connecting wire acts as a miniature antenna radiating its own field. Without proper precautions, these signals can cause a variety of disruptive effects. Radios and televisions can mistake the emissions for their signals, resulting in noise and confused communications.

Even worse, the wires inside a computer and nearby electronics also act as receivers. They may pick up undesired emissions and mistake the signals for something else, perhaps causing errors and mistaken readings.

To prevent interference, most computers are shielded either with metal or metal-lined plastic cases that block electromagnetic fields. Circuit traces can be kept short, reducing their antenna-like potential for sending or receiving emissions. The traces can even be laid out so that one shields another or cancels out the other's radiation. The ground and power signals on the Micro Channel bus, for example, are laid out to minimize emissions.

As computers become faster and faster, emission problems intensify. Higher frequencies mean shorter wavelengths, which are more effectively radiated by the shorter circuit traces inside computers. Shorter wavelengths can squeeze through smaller openings in the shielding afforded by the case and on the cables. Getting a faster computer to market takes longer because extra time is necessary to reduce the more prevalent emissions in order to receive FCC certification.

Potentially, emissions problems potentially can change how computers are made and even limit the number of computer makers. At higher frequencies, simply putting a new system board in an old box (as many smaller computer manufacturers do) may not be sufficient to meet the FCC's strict emission standards. And someday, only larger corporations may have the wherewithal required to design machines that keep emissions in check. ■

FACT FILE

FiveStar System 33/D
FiveStar Computers, 2100 North Greenville Ave., Richardson, TX 75081; (800) 752-5555, (214) 470-9000.
List Price: 1MB RAM, 60MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, monochrome monitor, $4,103; with 4MB RAM, 150MB ESDI hard disk, DPT SmartCache Caching Disk controller, VGA monitor, 80387-33 coprocessor, DOS 4.01, $8,298.
In Short: FiveStar's DPT-controller-enhanced hard disk performance distinguishes it from many other 386-33s. Processor performance is unexceptional, while price is reasonable. The 1-year on-site service is an attractive plus.

CIRCLE 405 ON READER SERVICE CARD

lem with having to split power leads.

The machine we received for testing had some interesting components, including a Video Seven FastWrite VGA. Surprisingly, this high-quality 16-bit video card had thoroughly unspectacular performance characteristics. You might want to consider an alternate video adapter. Fortunately, the disk controller was a DPT SmartCache Caching Disk controller, which is one of the new breed of intelligent controllers complete with its own on-board cache. It sports a 68000 processor of its own and takes a significant load off the CPU for disk operations, as demonstrated by two second-place finishes in the PC Labs disk benchmark tests.

Although the processor and memory benchmark tests placed the FiveStar System 33/D at the bottom of this sampling of machines, the difference separating it from the top performers is inconsequential. In the end, the FiveStar is a reasonable performer, but FiveStar needs to do far more to distinguish itself from the rest of the competition, particularly in terms of price. The on-site service is an attractive feature, but it is becoming more common every day. You will find more-innovative high-performance machines at roughly the same price, and more-competitively priced machines if you look elsewhere.

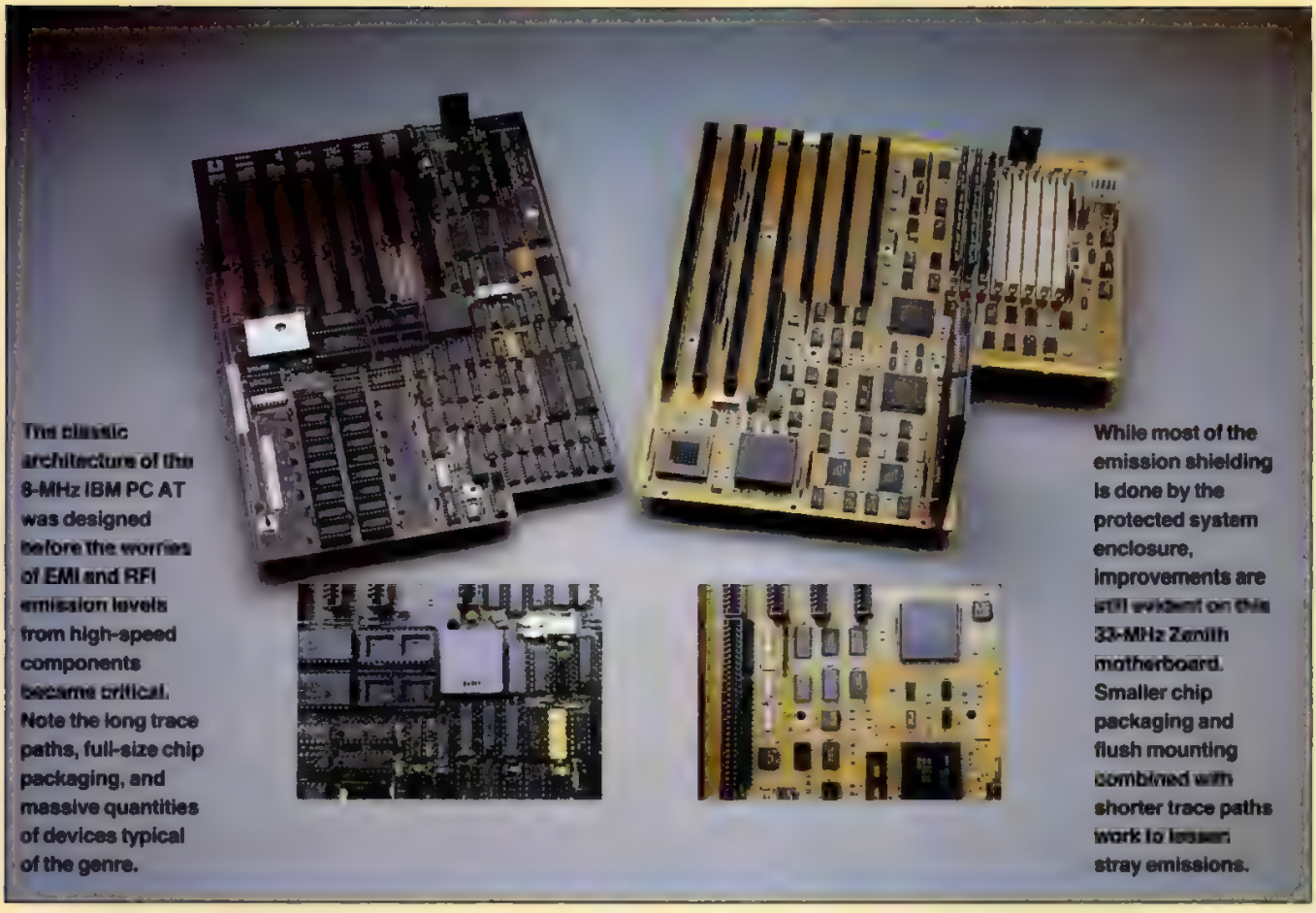
GATEWAY 2000

Gateway 386-33 Dream Machine

by Edward Mendelson

Gateway 2000 gave a lofty name to its 386-33 Dream Machine, but its remarkably inexpensive $5,995 desktop system is more solid and more mundane than any dreams you're likely to remember. It's a high-quality example of a generic 33-MHz machine—something that *was* a dream a few months ago but is now very much in the realm of reality.

Other vendors tweak their systems to improve performance, but Gateway's policy of using proven components without any significant change is likely to make this computer one of the most reliable systems you can find. In the PC Labs benchmark tests, the Gateway 2000 generally performed in the midrange.



The classic architecture of the 8-MHz IBM PC AT was designed before the worries of EMI and RFI emission levels from high-speed components became critical. Note the long trace paths, full-size chip packaging, and massive quantities of devices typical of the genre.

While most of the emission shielding is done by the protected system enclosure, improvements are still evident on this 33-MHz Zenith motherboard. Smaller chip packaging and flush mounting combined with shorter trace paths work to lessen stray emissions.

Gateway's $5,995 basic system comes with virtually everything you'll need to get started, including a 200-watt power supply, a Key Tronics 101-key keyboard, and DOS 3.3 or 4.01. The AMI motherboard has 4MB of 70-nanosecond RAM and a 64K 25-ns. hardware cache. The three half-height drive bays open to the front have 1.2MB and 1.44MB drives from TEAC, with a third bay available for a tape backup drive. The two internal drive bays hold a half-height 150MB MiniScribe ESDI hard disk with a Western Digital controller, allowing room for a second disk. An ATI VGA Wonder card drives a Gateway 2000 Crystal Scan 860 multiscanning monitor up to Super VGA 800 by 600 resolution. A 33-MHz 80387 math coprocessor brings the price to $6,720, with an extra $200 for the same configuration in a tower case.

FAMILIAR CLONE MODEL

The tower review unit is a familiar clone model with six open half-height bays. To get at the expansion slots, you have to lift the full metal cover off from the top and both sides instead of removing a separate side panel.

One oddity is that the case has a turbo switch on the front panel that does nothing at all. This is just as well, since the turbo switch is too close to the reset switch.

The AMI motherboard uses socketed RAM, so you can replace the 1-megabit (1Mb) chips with 4Mb chips when they become available. You can also add up to four 1Mb or 4Mb SIMMs to the sockets on the motherboard, although you may have to rearrange any especially large expansion cards so that they don't bump into the memory modules.

An optional 32-bit memory expansion card costs $250 with no memory installed and can hold 8MB of 1Mb DRAM chips. The motherboard has a bus speed of 8 MHz for compatibility, with one 8-bit and six 16-bit slots. It also has one socket that you can use with either an 80387 or a Weitek 3167 coprocessor.

FACT FILE

Gateway 386-33 Dream Machine
Gateway 2000, 106 West 8th St., Sergeant Bluff, IA 51054-2000; (800) 233-8472, (712) 943-2000
List Price: With 4MB RAM, 150MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, multiscanning monitor, DOS 3.3 or 4.01, $5,995; with 80387-33 coprocessor, $6,720; with tower case, $6,920
In Short: Gateway 2000's 33-MHz Dream Machine is a carefully assembled package of standard high-quality parts without surprises. A solid, conservatively designed machine that should be highly reliable and affordable

CIRCLE 406 ON READER SERVICE CARD

You can throttle the speed of the system down to 8 MHz from the keyboard, and you can also use the keyboard to switch the hardware cache on and off. Gateway 2000 sent separate manuals for the motherboard, boards, and other components but promises to have a single integrated manual shortly.



One of the most popular second sources of motherboards is American Megatrends Inc., with Boss Technologies, Dyna Computers, Gateway 2000, Micro Express, Tangent, Tri-Star, and Wedge Technology all using the AMI board. However, you need to install a daughterboard if you wish to have simultaneous use of Weitek and 80387 coprocessors.

The Weitek 1167 and Intel 33-MHz 80387 coprocessors are supported either separately or together; our review unit included the 80387 only. For these coprocessors to operate simultaneously, you need a special Weitek daughterboard.

The two banks of DIP sockets and two banks of SIMM sockets on the motherboard can hold up to 8MB of 1-megabit DRAM. To bring the system up to a full 16MB of 32-bit RAM, you can install a memory card in the proprietary 32-bit slot.

CONTINUES

FACT FILE

Micro Express 386-33
Micro Express Inc., 2114 S. Grand Ave., Santa Ana, CA 92705; (800) 642-7621, (714) 662-1973
List Price: With 4MB RAM, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, $5,995; with 150MB hard disk, VGA monitor, 80387-33 coprocessor, $8,249.
In Short: With its AMI motherboard and quality components, the Micro Express 386-33 proved to be a solid performer on nearly all the PC Labs benchmark tests, turning in especially strong times on our processor and memory tests. Four months of on-site service are included with a 1-year parts-and-labor warranty.

CIRCLE 408 ON READER SERVICE CARD



Gateway 2000's 386-33 Dream Machine is just that, with its quality components, 4MB RAM, a 150MB hard disk, two disk drives, and VGA for only $5,995. Add an 80387 coprocessor and a tower case, and the price is $6,920.

Gateway 2000's warranty offers 1 year of parts and labor, and the company ships any replacement parts (overnight if necessary) before receiving the original back from you. It's a cost-saving approach, but the conservative engineering and quality parts should prove highly reliable.

MICRO EXPRESS INC.

Micro Express 386-33

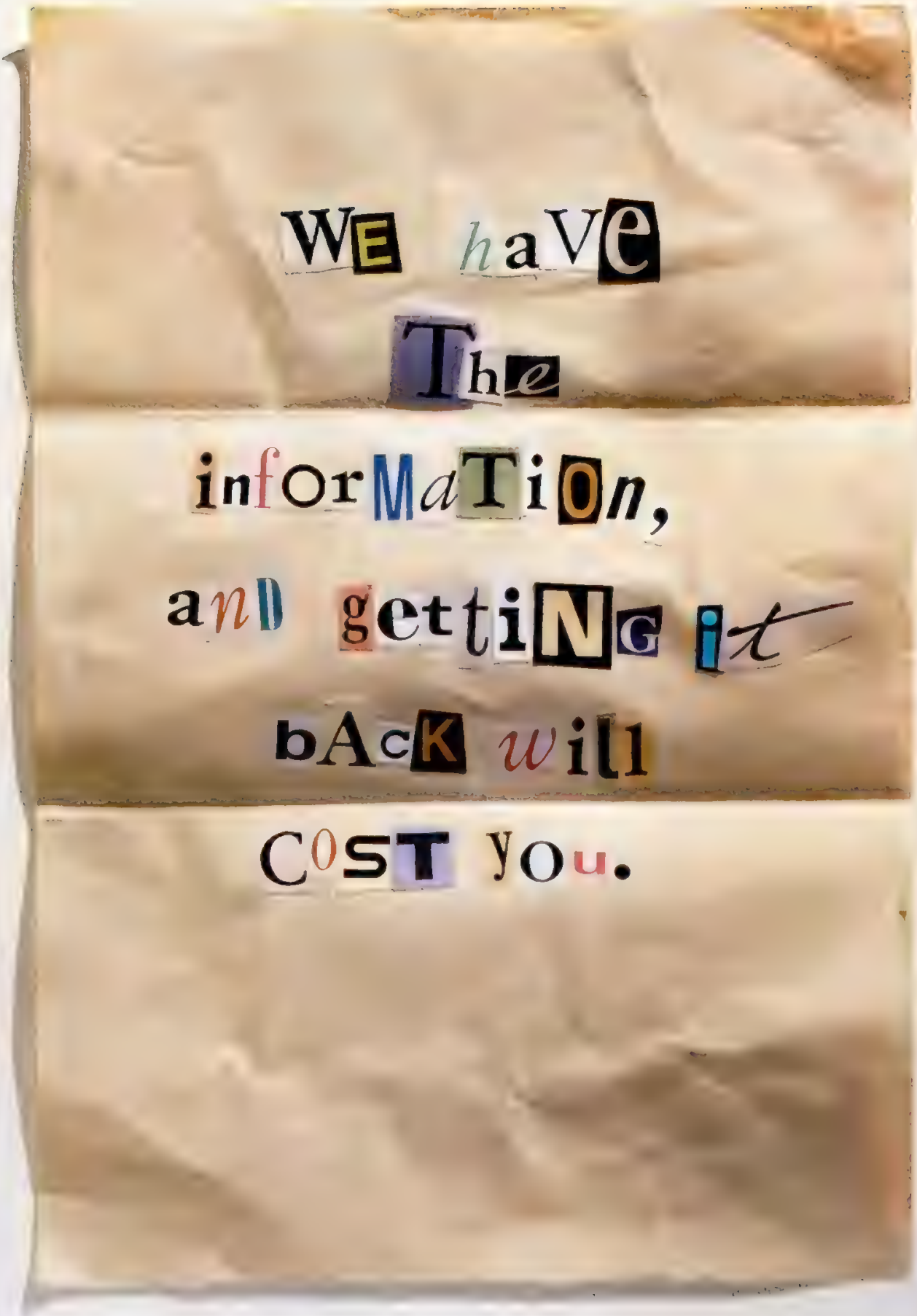
by Catherine D. Miller

Micro Express recognizes that people in the market for a state-of-the-art 33-MHz machine are likely to be running memory-hungry applications: the $5,995 basic configuration of its Micro Express 386-33 ships with 4MB RAM.

The heart of the machine is the AMI (American Megatrends Inc.) 33-MHz motherboard, which comes standard with a 64K direct map cache composed of 20-nanosecond SRAM chips. If you lower the microprocessor's 33-MHz clock speed to 8 MHz, you must activate the cache by a key combination. (The bus operates at 8 MHz only.)

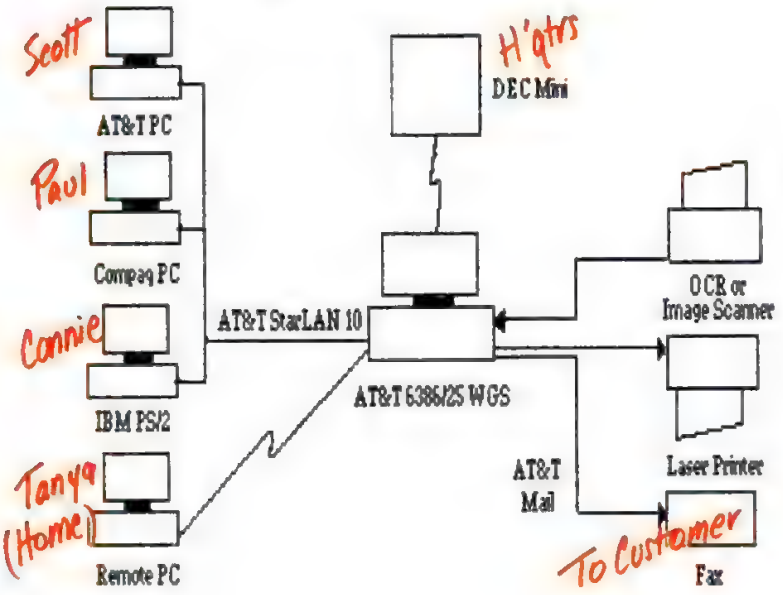


The Micro Express 386-33 combines the AMI motherboard with quality components to attain solid 33-MHz performance. With 4MB RAM, a 150MB hard disk, two floppy disk drives, VGA, and an 80387 coprocessor, it lists for $8,249.


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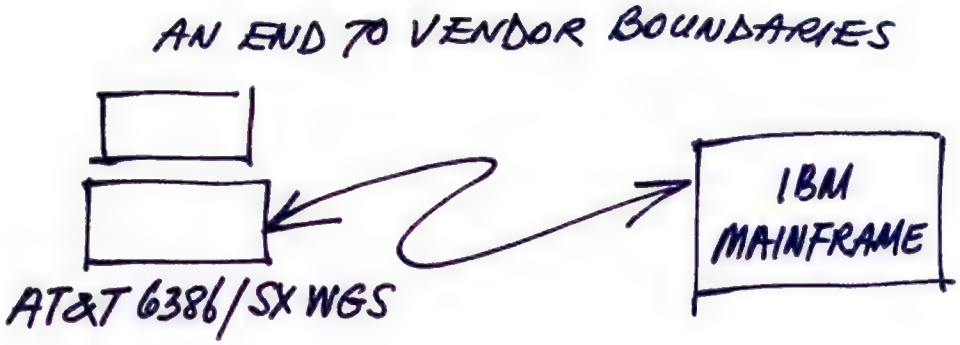
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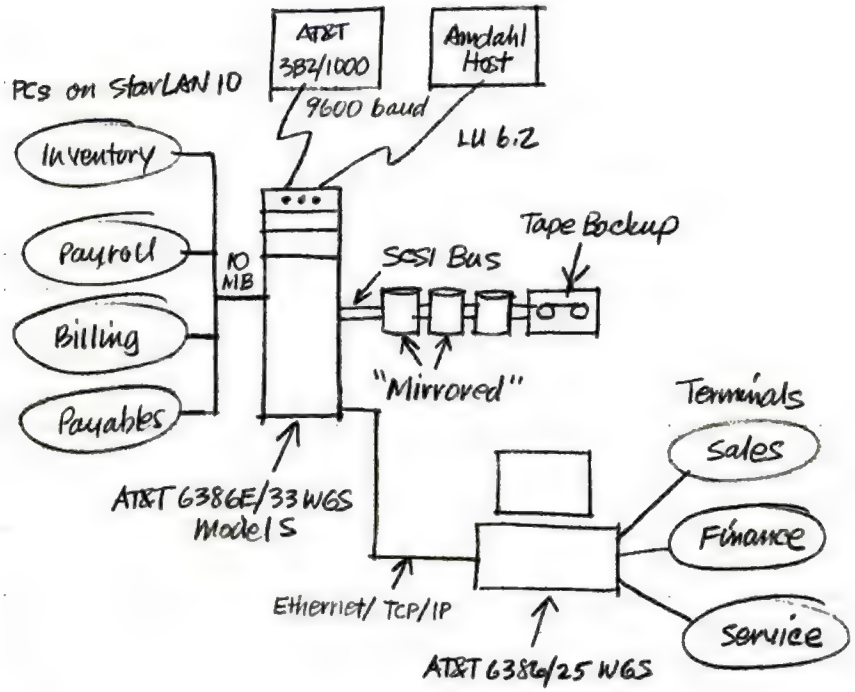
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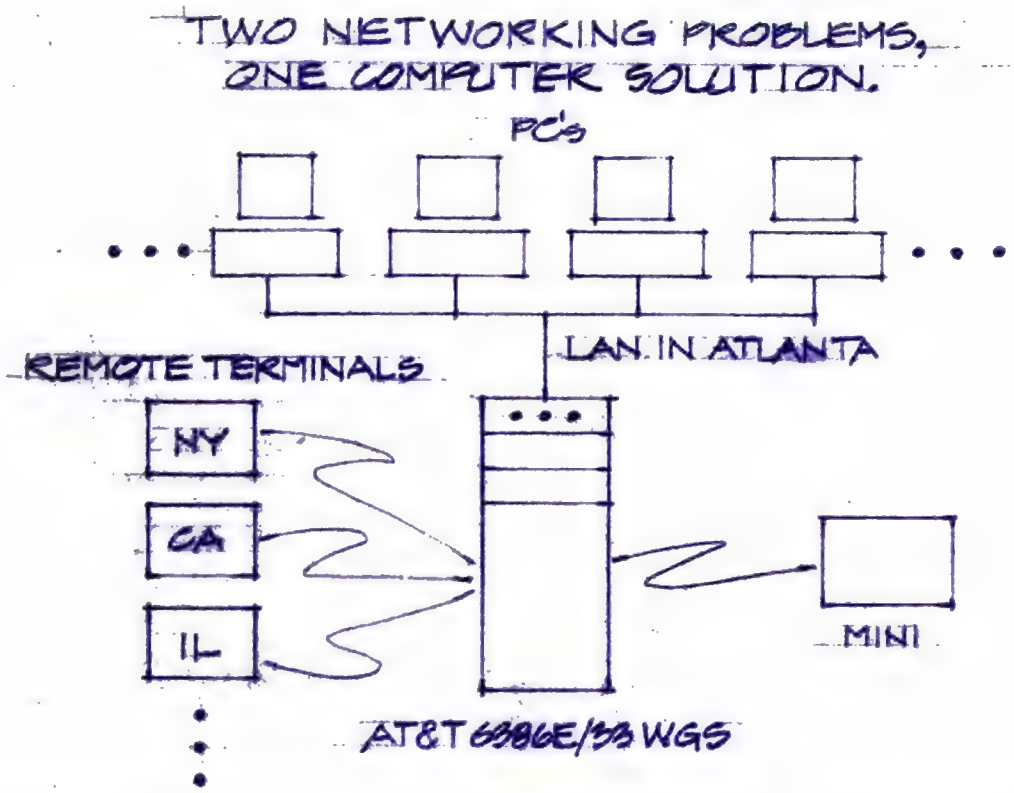
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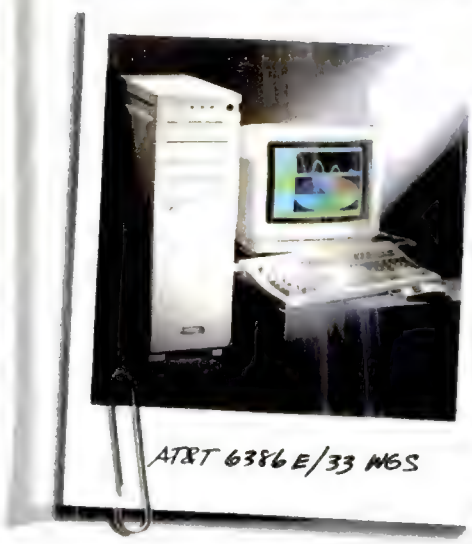
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Alternatively, you can use rare and expensive 4MB DRAM to get 16MB RAM directly on the motherboard. Our desktop review unit (the machine is available in a tower configuation) included 4MB of 70-ns. 1Mb DIP-type DRAM.

The $8,249 evaluation unit also included Data Technology Corp.'s floppy/hard disk controller, capable of handling two ESDI interface Winchester hard disks and two floppy disk drives. If you need added capacity, a software driver lets this controller support a third floppy disk drive. The omnipresent TEAC 1.2MB floppy disk drive and Control Data Corp.'s ESDI hard disk (with an unformatted capacity of 182MB) occupied three of the five half-height drive bays. The one 9-pin serial and one 25-pin parallel port are courtesy of Everex's Magic I/O card; five cutouts for extra ports are also included.

The unit was shipped with the Maxi-Switch keyboard, which has low, firm keys but no clicky feel. If you prefer, you can request a clickier Chicony unit.

MEETING PERFORMANCE STANDARDS

VGA graphics were supplied by the 16-bit Paradise VGA Plus 16 card and the NEC MultiSync II monitor. The Paradise card performed fairly well on all PC Labs video benchmark tests, in part because of its effective use of video shadow RAM by the system board.

On all PC Labs memory and processor benchmark tests, the Micro Express 386-33 rated as one of the top performers. The fast memory chips, 64K cache, and effective motherboard architecture contribute to the system's strong performance.

Although the machine was one of the fastest on our large-record DOS File Access test, it turned in comparatively mid-range times for the small-record File Access test.

As this article went to press, Micro Express began shipping its basic system with a 1.44MB floppy disk drive in addition to the standard 1.2MB floppy disk drive. Also, the system now comes with the DPT SmartCache Caching Disk controller card, which includes 512K of cache memory. Disk performance under the SmartCache improves drastically.

Micro Express's warranty covers 4 months of on-site service plus the standard 1 year of parts and labor. That, as well as its solid performance, quality components, and reasonable price, make the Micro Express 386-33 a strong contender in the 33-MHz market.

NORTHGATE COMPUTER SYSTEMS INC.

Northgate Elegance 386/33

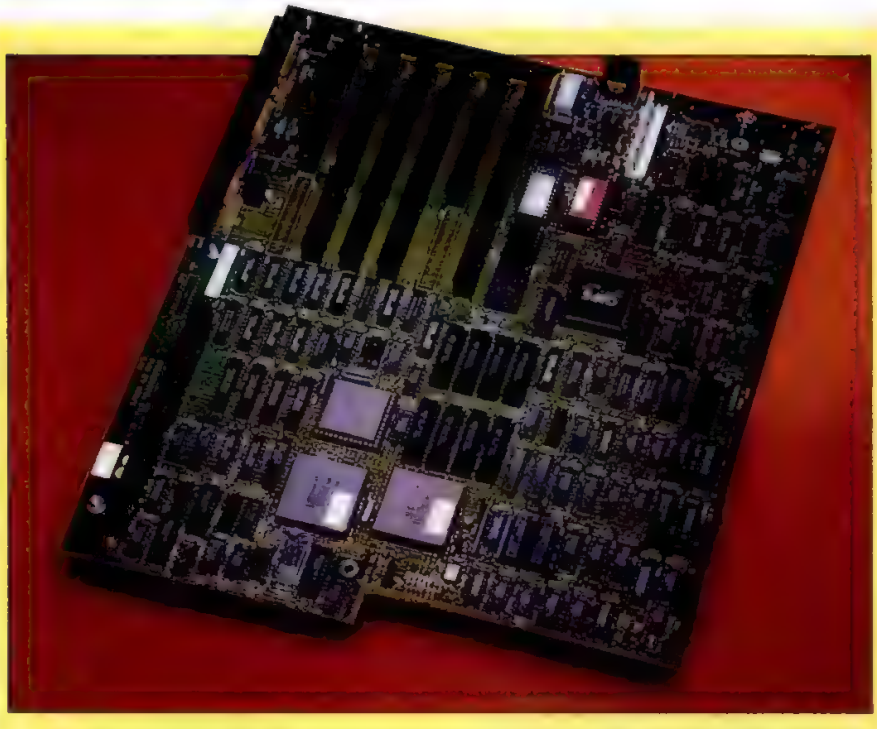
by Bruce Brown

Northgate Computer Systems has established a reputation for producing systems that combine high-speed performance and enticing features at a reasonable price. Not surprisingly, Northgate's Elegance 386/33 is up to the mail-order company's usual high standards.

The base configuration costs $4,799 with a 68MB RLL-encoded hard disk. That price also includes 1MB RAM with 64K cache memory, a 1.2MB and 1.44MB floppy disk drive, and a monographics video display with a 14-inch flat-screen amber or white monitor. DOS 4.01, GW-BASIC, the highly rated *PC-Kwik* performance utilities, and Northgate's own utility software are also included. The hard disk drive comes formatted and with



Northgate's Elegance 386/33 combines top-notch performance with reliable components and superior documentation to attain one of the best values around. Our standard configuration costs only $7,899.



High technology doesn't always look like high technology. Northgate squeezes impressive performance out of its motherboard with traditional AT design. What was formerly an 8-bit I/O slot is instead the increasingly common 32-bit memory expansion slot, but Northgate has shunned VLSI in favor of discrete componentry. Even the cache controller is a collection of discrete ICs.

DOS loaded, so all you have to do is unpack the system and plug it in.

Of course, most people who buy 33-MHz systems want more than just a basic unit. The cost of the $7,899 review model includes 4MB RAM, a 150MB ESDI hard disk drive, an 80387 33-MHz math coprocessor, a 16-bit Video Seven V-RAM VGA card, and a Princeton Graphic Systems monitor.

The system uses Northgate's own motherboard; AMI makes the BIOS. If necessary, the system clock can be powered down to 8 MHz for extremely finicky software. At this speed, the expansion bus slows down too, clopping along at 8 MHz. Even when the system wails away at 33 MHz, the expansion clock doesn't, running at a conservative 8.25 MHz.

The machine can hold up to 8MB of 32-bit DRAM on the motherboard; another 8MB can go on an expansion board in the single 32-bit slot. For most users, the standard 64K cache (expandable to 256K) should be ample: while other caching schemes benefit only memory reading, Northgate caches both memory reads and writes.

The Northgate's benchmark scores bespeak its high-speed architecture. The Northgate Elegance tied for first place with the ALR FlexCache in the 80386 Instruction Mix test. While our Conventional Memory test doesn't reflect the advantage of cache memory (which accounts for Northgate's average results in this area), the rest of the benchmark tests show the system to be an excellent performer all around.

FACT FILE
EDITOR'S CHOICE

Northgate Elegance 386/33
Northgate Computer Systems Inc., 13895 Industrial Park Blvd., #110, Plymouth, MN 55441; (800) 548-1993, (612) 553-0111.
List Price: With 1MB RAM, 68MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, monochrome monitor, DOS 4.01, GW-BASIC, utilities, $4,799; with 4MB RAM, 150MB hard disk, VGA monitor, 80387-33 coprocessor, $7,899.
In Short: Northgate's Elegance 386/33 combines top performance, good components, and aggressive pricing. With the company's customer-oriented features such as on-site service, on-line system reference manual, and a terrific quick-reference card, it's easy to see why Northgate continues its rapid growth.

CIRCLE 406 ON READER SERVICE CARD

CONFIGURATION CHOICES

The desktop test unit (the system is also available in a vertical case) can hold five half-height drives. Northgate currently offers seven drive choices with this model: 40- and 80MB SCSI (small computer system interface) drives; 68- and 108MB RLL (run length limited) drives; and 130-, 150-, and 300MB ESDI (enhanced small device interface) drives.

Besides the proprietary 32-bit expansion slot, there are slots for one 8-bit and six 16-bit boards. Standard ports handle one parallel and two serial devices. A 220-watt power supply has ample energy to run a loaded system.

You have your choice of keyboards—as long as your choice is a Northgate OmniKey brand. The two models to choose from are the OmniKey 102 and the newer OmniKey Plus. Both have an active, responsive feel, and each sports 12 function keys on the left. The major difference beween the two is that the OmniKey Plus has two full cursor-control keypads on the right.

Northgate provides a standard 1-year parts-and-labor warranty. In addition, business users of this FCC Class A system get a full year of on-site service from Sorbus Systems at no charge. Northgate will also ship replacements for identified defective parts overnight—that is, *before* you send in the old parts.

Old suspicions die hard, and some people will never buy a computer through the mail, no matter how good a deal they can get. But if you don't mind mail-order shopping, the Northgate Elegance 386/33 gives you a smart combination of price and performance, as well as good customer support.



With PC Brand's 386/33 Cache, you get a lot for your dollars. Our evaluation unit came with 4MB RAM, a 150MB ESDI hard disk, two floppy disk drives, VGA, and an 80387 coprocessor in a tower case for only $5,900.

PC BRAND INC.

PC Brand 386/33 Cache

by Alfred Poor

Here's a price: $2,799. And here's what it is attached to: a base model PC Brand 386/33 Cache computer. Must be stripped to nothing, right? Wrong. That price includes 1MB RAM, a 1.2MB or 1.44MB floppy disk drive, DOS 4.01, and *Microsoft Windows/386*. The $5,900 price for the review unit, equipped with 4MB RAM, a 150MB hard drive, two floppy drives, and color VGA display, is lower than some competitors' base model prices!

You don't sacrifice quality for low price, either. The PC Brand machines are an efficient combination of in-house engineering and top-notch, off-the-shelf parts. Even the base model uses the Adaptec B-16 series ESDI hard/floppy disk controller, a unit that boosts hard disk performance with an on-board memory cache.

The test unit came equipped with a Deico Electronics DVGA-16 card, which supports up to 1,024- by 768K resolution and is an outstanding device. We tried it on a standard 8-MHz IBM AT and discovered that it was third-fastest compared with the 15 high-performance VGA cards tested in *PC Magazine*'s July 1989 issue.

The tower case (a desktop model is also available) includes an extra fan for the expansion card cage. The single 32-bit slot on the motherboard was stuffed with a memory card that can hold up to 8MB of 1-megabit (Mb) DIP chips. An optional daughterboard can bring the system up to 16MB of 32-bit RAM. If you prefer, it's possible to purchase a memory card designed to take either 1Mb or 4Mb SIMM chips. Fully loaded with 4Mb SIMMs, the system packs a whopping 64MB of fast 32-bit RAM.

The review unit also came equipped

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Anytown, USA—The unidentified victim was apparently among the millions of people who still think that DOS Backup and Copy commands are a safe and convenient way to back up their valuable hard disk data.

It is not known whether the shocking loss was a result of natural aging while DOS made the backup, or whether the victim pulled his hair out in frustration after discovering that a minor disk error had rendered his entire backup set useless.

According to reliable sources, the tragedy could have been averted if the man had been using **FASTBACK PLUS**, the world's fastest and most reliable backup software.

A special commission has been appointed to study ways in which the public can be made aware that **FASTBACK PLUS**' *Advanced Error Correction, easy-to-use menu, flexible file and directory selection, automated backup options* and other features allow even beginners to make fast, foolproof backups.

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with Intel's 80387-25-MHz math coprocessor; the Intel 82385 controller (rated for 33 MHz) drives the 32K 25-nanosecond static RAM cache (expandable to 64K).

PC Brand offers a 5-year prorated warranty that covers parts and labor. If the company can diagnose the problem and identify a specific failed component, it will send a replacement part by Federal Express. PC Brand systems also come with a 30-day money-back guarantee.

SPEED AND OTHER ISSUES

In the best of all possible worlds, a system this inexpensive would lack nothing you desire. But if what you desire is pure speed, be aware that this machine doesn't garner top honors. While no slug, the system rated midrange marks on most tests.

In addition, the tower case is a typical clone box with a few design flaws. For example, it is entirely too easy to hit the big reset button that sticks out at the top of the case. And you may find the cost of a quality replacement keyboard to be a worthwhile investment.

The documentation is also poor. Although we were supplied with a preliminary manual, its appearance gives no indication that the final reference will be extensive enough to cover a range of users from novice to expert. Unless you are familiar with computers and willing to work a bit, the skimpiness of the documentation may be a deterrent.

In the final analysis, however, it is hard to imagine a better bargain in its field than the PC Brand 386/33 Cache. While it has a few flaws, none of them are major, and the components are of high quality. And when you consider the price for a fully configured system, it may well be among the best values.

FACT FILE

PC Brand 386/33 Cache
PC Brand Inc., 954 W. Washington St., Chicago, IL 60607; (800) 722-7263, (312) 226-3500.
List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, DOS 4.01, *Microsoft Windows/386*, $2,799; with 4MB RAM, 150MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, 80387-25 coprocessor, tower case, $5,900.
In Short: PC Brand proves that you need not sacrifice quality components or performance to get a rock-bottom price. While there is still room for improvement, the 386/33 Cache represents an outstanding value.

CIRCLE 410 ON READER SERVICE CARD

PC LINK CORP.

PC Link 386-33

by M. David Stone

The $5,995 base price of the PC Link 386-33 may cause some eyebrows to rise. But although the cost is relatively high, you get a fair amount of standard features, including 4MB RAM, a 159MB hard disk drive, a 1.2MB or 1.44MB floppy disk drive, a 16-bit Trident VGA card, one parallel and one serial port, and your choice of DOS 3.3 or 4.01.

You can tack on another $179 for a monochrome VGA display, $525 for a color VGA monitor, or $689 for the NEC MultiSync 3D. Our review system, with the MultiSync display, an Orchid Technology Prodesigner VGA Plus card, an 80387 33-MHz math coprocessor, and two floppy disk drives, totaled $7,868.

The review system was shipped with a 17-millisecond, 155MB MiniScribe hard disk. According to PC Link, this is what the original design mandated. But PC Link's difficulty in obtaining MiniScribe



The PC Link 386-33, based on a Hauppauge motherboard, offers midrange performance and price. With 4MB RAM, a 150MB hard disk, two floppy disk drives, VGA, and an 80387 coprocessor, the system lists for $7,868.



Compared with that of most other motherboards, the Hauppauge design featured in the PC Link 386-33 is almost Danish in its stark simplicity. Chip layout is quite orderly, with VLSIs taking much of the burden away from what would have otherwise been a larger array of discrete ICs. I/O slots include one 8-bit, six 16-bit, and one 32-bit expansion slot for additional memory.

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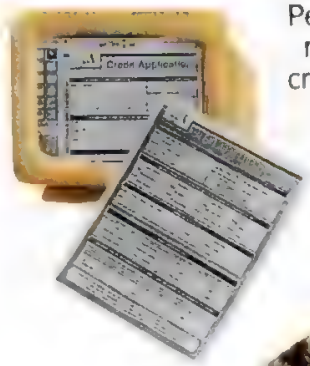
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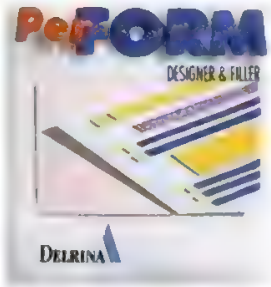
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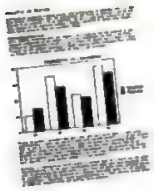
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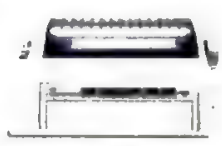




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PC Link 386-33
PC Link Corp., 29 W. 38 St., New York, NY 10018; (800) 221-0343, (212) 730-8036.
List Price: With 4MB RAM, 159MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, 16-bit VGA adapter, DOS 3.3 or 4.01, $5,995; with 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, 80387-33 coprocessor, $7,868.
In Short: The PC Link 386-33 offers few configuration options, but the choices it offers are generally well considered. The base system is very nearly identical with the *PC Magazine* standard configuration. A reasonable machine, but it should cost less.

CIRCLE 411 ON READER SERVICE CARD

drives means that current production models are shipping with 159MB Micropolis units. That's no cause for alarm: while the MiniScribe scored solid middle ratings on the hard disk benchmark tests, the Micropolis unit is actually slightly faster.

INTERIOR AND EXTERIOR DESIGN

The AT-style box accommodates five half-height drives, with a maximum of three accessible. This arrangement offers reasonable flexibility in what you can mount in the system.

The Hauppauge Computer Works system board is equipped with the Chips and Technologies chip set and the Award BIOS. A nice touch is that the board has separate sockets for the 80387 and the Weitek 3167 coprocessors. While the 4MB of 80-nanosecond DIP-type DRAMs exhaust the capacity of the Hauppauge board, you can add up to 16MB more on the 32-bit memory card.

One potential annoyance in the system board design is that 2MB of RAM are inconveniently lodged under the left-side drive bays. If you bake a memory chip, it is necessary to remove the system board in order to get at it.

Slotwise, there's room for one 8-bit and six 16-bit expansion cards, as well as the 32-bit memory card. Three slots in the test system were taken up by the Adaptec ESDI controller, the VGA card, and the serial/parallel card. Although the system does not have a second serial port, you can add one on a ribbon cable without tying up another slot, thanks to five extra cutouts on the back of the case.

The turbo switch is notable in that it actually works. The clearly labeled reset switch is slightly recessed and positioned so that you can't accidentally activate it.

PC Link offers a choice in 101-key keyboards. If you like quiet typing, get the Key Tronic. If that's too mushy, choose the clickier Chicony model.

One of the problems with the system is that your configuration choices are limited. Apart from the consideration that the base system may contain more features than you want, the range of disk drives to choose from is skimpy. You can pick a 159MB or 330MB model; a 670MB disk may be available by the time you read this. Another problem is that on-site service is not yet available.

You should note the scores on the processor and memory benchmark tests. While the difference between the best and worst system scores is too small to be a major issue for many users, the PC Link system achieved below-average scores on all tests. Additionally, it scored dead center or a little worse on the screen update tests.

Overall, the PC Link 386/33 is a credible system, but nothing about it stands out. If it performed more impressively and were priced more aggressively, it might be worth your interest. However, there are other systems that cost less and deliver equal or better performance.

POLYWELL COMPUTERS INC.

Polywell Polysystem 33 Cache

by M. David Stone

If you're on a tight budget but want to get into the 33-MHz game, consider plunking down $3,300 for Polywell's Polysystem 33 Cache.

While the base price doesn't include a hard disk, you do get 4MB RAM, a 1.2MB floppy disk drive, two serial ports, two parallel ports, a game port, a 14-inch black-and-white flat-screen monitor, and your choice of DOS 3.3 or 4.01. For $375 more, Polywell will add a 23-millisecond 45MB hard disk, giving you a complete system for $3,675.

If you have a little more cash, you can opt for a system like the one we reviewed: 4MB of SRAM in four 1-megabit (Mb) surface-mount SIMMs, 128K of 20-nanosecond RAM cache, a 158MB hard disk, both 1.2MB and 1.44MB floppy disk drives, an 80387-33-MHz math coprocessor, an Excelogic 16-bit Super VGA board, and a 14-inch Seiko Super VGA monitor. The $6,890 price is still lower than that of some comparable systems.

The review system tested by PC Labs came in a desktop chassis, although the company says it normally offers a tower configuration. If your computer is going to be subjected to a lot of wear and tear, a heavy-duty chassis with ten half-height bays is available for an additional $700.

The Polywell Polysystem 33 Cache is built around a Mylex motherboard equipped with the Phoenix BIOS, Mylex keyboard BIOS, and a combination of custom logic and the I/O bus control chip from the Chips and Technologies chip set. Notable for its complete absence from the motherboard is system memory. Instead, Mylex puts all RAM on a 32-bit memory board; in the review unit, four additional SIMM sockets leave space for 4MB more of RAM for a maximum of 8MB.

A second 32-bit slot is available (for expansion to 16MB RAM), as are one 8-bit and four 16-bit slots. In the review unit, an Adaptec controller, the VGA card, and a parallel/serial card ate up precious slot space. The complete allocation of memory to expansion cards means that you should carefully plan how to use your slots.

One minor annoyance, for instance, was that one slot was tied up with additional connectors attached to the parallel/serial card. This is unnecessary, since the system sports five cutouts in addition to the slots. According to Polywell, the company will supply appropriate connectors that won't tie up slot real estate. Be sure to take them up on this offer.

A more troublesome problem is the

FACT FILE

Polywell Polysystem 33 Cache
Polywell Computers Inc., 61C Airport Blvd., South San Francisco, CA 94080; (800) 999-1CPU, (415) 583-7222.
List Price: With 4MB RAM, 1.2MB 5.25-inch floppy disk drive, monochrome monitor, DOS 3.3 or 4.01, tower case, $3,300; with 100MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, 80387-33, $6,155; with 158MB hard disk, Seiko Super VGA monitor, $6,890.
In Short: The Polysystem 33 Cache is something of a mixed bag, with good performance on the processor and memory benchmark tests but below-average performance on the hard disk and video tests. Even so, the low price makes this system interesting.

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PC MAGAZINE
EDITOR'S CHOICE
March 28, 1989

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way the crystal that controls bus speed is mounted on the motherboard. The crystal plugs into a socket; the design is meant to allow you to change the bus speed by replacing the crystal. Alas, the crystal can easily pop out of the socket, as it did on the review system. When PC Labs sent the nonfunctioning system back, Polywell returned the computer with the crystal tied to the socket. The company says that in the future, all systems will be shipped in this manner.

PERFORMANCE UPS AND DOWNS

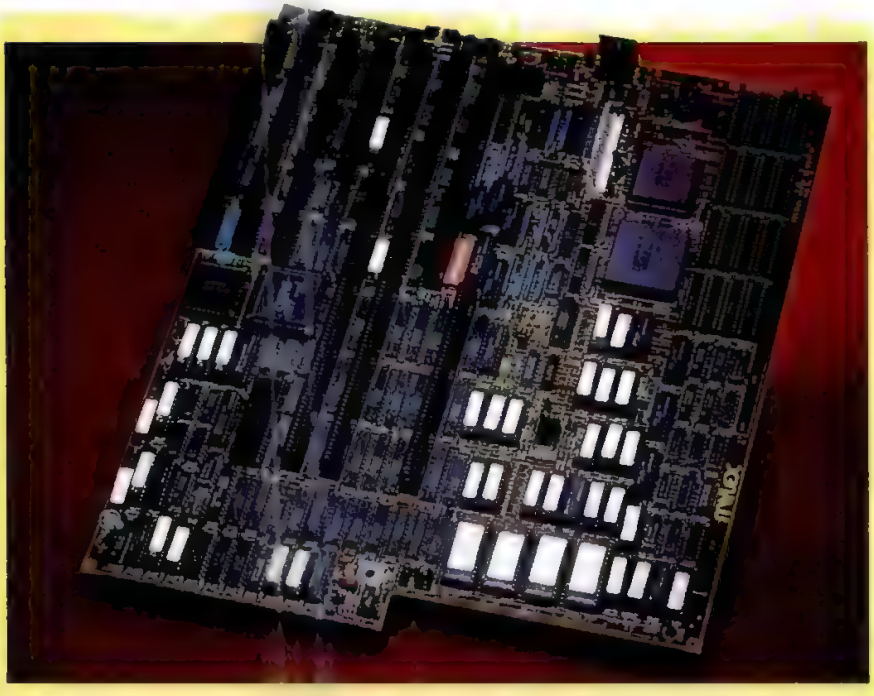
On the PC Labs processor and memory benchmark tests, the Polywell Polysystem 33 Cache ranked in the upper half of the group. Unfortunately, its performance did not hold up in other respects. On two of the three disk tests, the unit pulled in scores far below average.

The video tests were even more disappointing, with the system coming in dead last on two tests and well toward the bottom on the third.

All told, the Polywell is a somewhat flawed system, but one that sells for a low-enough price to make it interesting anyway. This will not be your be-all and end-all dream machine, but if price is an issue, it may suffice.



Polywell's Polysystem 33 Cache is a real bargain at $3,300 for 4MB RAM, a 1.2MB floppy disk drive, monochrome video, and DOS. Our standard configuration is also affordable at just $6,890.



Produced by a common second-source company, the Mylex motherboard from the Polywell Polysystem 33 Cache posed a unique problem for this review. One computer slated for review, from Whole Earth, was equipped with a Mylex board that simply refused to work, and a replacement was not available at the time. Mylex offers two Intel-type 32-bit expansion slots.

TANGENT COMPUTER INC.

Tangent Model 333

by M. David Stone

In a world of generic 386 PCs, Tangent Computer explicitly recognizes that it is only one of many sources of essentially similar machines. It therefore stresses its expertise and its ability to customize configurations to the customer's needs.

Tangent does offer some standard configurations for its 33-MHz 386, the Model 333. The $3,945 basic configuration includes 1MB RAM, a 1.2MB floppy disk drive, a Toshiba 22-millisecond 67MB hard disk, one parallel port, two serial ports, and a monochrome card and monitor. The system we tested, with a CDC 151MB hard disk, 16-bit Video Seven FastWrite VGA card, and VGA monitor, goes for $7,528. Both prices include 1-year on-site service.

Tangent's emphasis on customization is partially evidenced by its commitment to meeting your hard disk drive needs. Though its standard hard disk choices are 67, 96, 151, 330, and 652MB, if you want your 33-MHz machine to have a 101MB drive, for instance, Tangent will accommodate you.

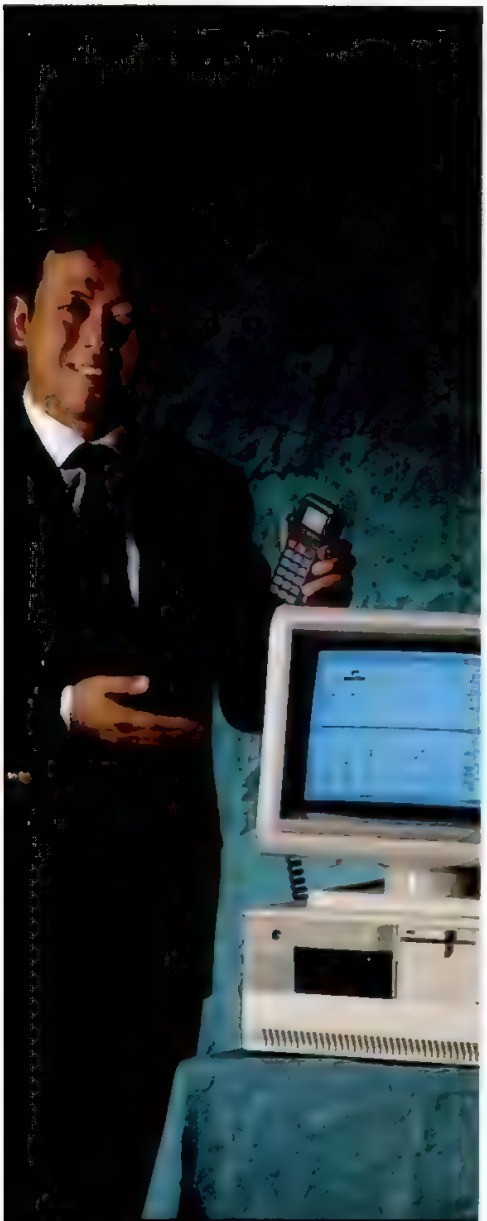
The Model 333 can also be configured in any style of case that Tangent sells—including a standard tower or supertower chassis; just pick whichever best fits your needs. If you're looking for a monochrome, low-end 386 system (if indeed there is such a thing), your expansion needs should be satisfied by Tangent's tower chassis, with room for eight half-height drives. If you need room to grow, the supertower, which was supplied for this review, offers ten half-height drives.

OPENING UP THE SUPERCHASSIS

The ten half-height drive bays are all immediately behind the lockable front-panel door. With the door closed, you can have access to as many as six drives; with the door open, you have access to all ten. Although the supertower case is generally well designed, it unfortunately suffers from some minor but potentially troublesome flaws.

The reset and keyboard disconnect switches, for example, are hidden safely behind the front-panel door—next to each other. This is a questionable placement; it doesn't help that the switches aren't labeled, either.

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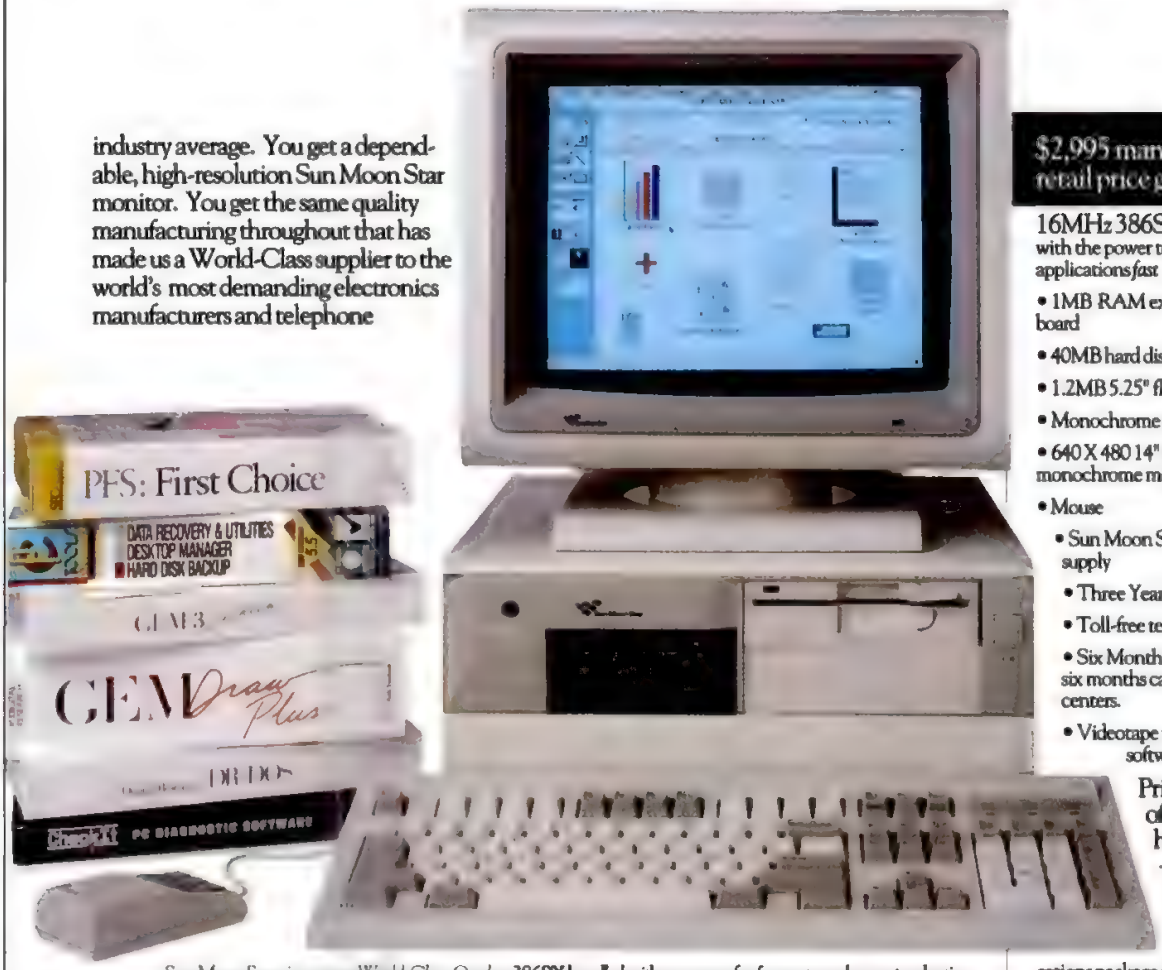
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Inside the case, you'll find an AMI motherboard with the Chips and Technologies chip set and AMI BIOS. The tested system also came equipped with an 80387 33-MHz math coprocessor. You can replace the 80387 with a Weitek 3167 or install both coprocessors by way of an adapter available from Weitek.

Also on the motherboard are the typical eight slots—one 8-bit, six 16-bit, and one 32-bit. Four additional cutouts let you use the connectors on ribbon cable, without tying up an extra slot.

System RAM comes in the form of 4MB of 70-nanosecond DIP-type DRAMs. Four SIMM sockets allow for up to 4MB more on the system board. The 32-bit memory board will hold 8MB more.

On PC Labs processor benchmark tests, the Tangent Model 333, with its 64K of 15-ns. RAM cache, came in near the middle of the pack, pulling a little ahead in some instances. On the hard disk and screen-update tests, the Tangent system again scored generally in the midrange.

Keep in mind that disk performance depends very much on the particular disk and controller card. For the review machine, Tangent supplied a garden-variety Western Digital controller. But the DPT controller with built-in cache is available as an option and results in much faster disk performance.

One important consideration is that if you are unhappy with the configuration supplied, Tangent will rebuild the unit to your specifications. A company spokesman says that Tangent is extremely willing to reconfigure a system because "we feel we will get more business by keeping customers happy." That attitude alone may be enough to make Tangent the company of choice for some users.

FACT FILE

Tangent Model 333
Tangent Computer Inc., 303 Beach Rd., Burlingame, CA 94010; (800) 223-6677, (415) 342-9388
List Price: With 1MB RAM, 67MB hard disk, 1.2MB 5.25-inch floppy disk drive, monochrome monitor, $3,945; with 4MB RAM, 101MB disk, VGA monitor, 80387-33 coprocessor, DOS 3.3 or 4.01, $6,488; with 151MB drive, 16-bit VGA adapter and monitor, $7,528.
In Short: The Tangent Model 333 offers performance and workmanship at a low price, with customization and support as Tangent's most important features. In addition to offering the standard 30-day money-back guarantee and 1-year on-site service, Tangent will build your machine to specification.

CIRCLE 413 ON READER SERVICE CARD



The Tangent Model 333 stands apart in its commitment to customization. Our tested unit had 4MB RAM, a 151MB hard disk, two floppy disk drives, VGA, and an 80387 coprocessor in a supertower case for $7,528.

TRI-STAR COMPUTERS

Tri-Star Flash Cache 386^{33}

by Bruce Brown

Tri-Star Computers obviously believes that it doesn't make sense to nickel-and-dime it in the 33-MHz 386 market. The minimum configuration of the company's Flash Cache 386^{33} includes 4MB of RAM.

For the attractive $4,995 price of the base system, you also get a 65MB RLL hard disk, two serial ports and one parallel port, plus your choice of a 1.2MB or 1.44MB floppy disk drive. The $8,790 price of the Class A–rated test system—with a 110MB hard disk, both floppy disk drives, an 80387 33-MHz math coprocessor, MS-DOS 4.01, a VGA display, AMI BIOS, and a 60MB tape drive—is reasonably aggressive.

The Flash Cache in the upright tower case measures 25.75 by 8 by 18 inches (HWD). Since a loaded 386 is no lightweight—roughly 45 pounds depending on components—the Tri-Star's vertical case is fitted with a handle to make moving easier. When in place, two fold-out feet on the bottom of the case add stability.

ROOM FOR EXPANSION

The 80386 processor runs at either 33 MHz or a lowly 8 MHz. At a system speed of 33 MHz, the expansion bus runs at a comparatively sedate 8.25 MHz; it moves at a straight 8 MHz at the lower speed.

You can put a total of 8MB RAM directly on the motherboard; Tri-Star's current price for a 4MB motherboard upgrade is a digestible $800. Another 8MB more can be added via a 32-bit memory card.

In addition to the proprietary 32-bit slot, you get two 8-bit and six 16-bit expansion slots. There are also ten knockouts on the back of the box to accommodate interface connectors from multiple-port expansion boards.

Inside the upright case there is room for six half-height drives, three of which can be used with removable media. The 220-watt power supply delivers sufficient oomph for a fully packed box. But since there are only four device power leads, you'll have to get splitters if you want to



The Tri-Star Flash Cache 386^{33} offers solid performance and quality components at a competitive price. With 4MB RAM, a 110MB hard disk, VGA, and an 80387 coprocessor, it is only $7,114.

BRIDGES



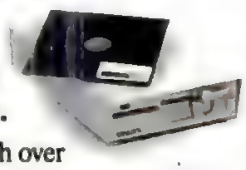
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completely fill the box with six drives.

The test machine came with a hot combination of an ATI VGA Wonder board and a NEC MultiSync 3D monitor. If you need the 33-MHz speed for CAD/CAM and illustration work, this 1,024 by 768 VGA system is a top-flight combination. If you spend more time with your keyboard than you do with a mouse, you'll be glad to know that the accompanying Unitech 101-key model is reasonably responsive.

PERFORMANCE, WARRANTY FACTORS

With some help from the 64K nonexpandable cache memory and system and video BIOS shadow RAM, the machine held its own on most of our benchmark tests, scoring particularly well on the 80386 Instruction Mix test, though it fared less impressively on the small- and large-record DOS File Access tests.

Tri-Star has a four-part Customer Assurance Program that bears mention. The first ingredient is a 30-day satisfaction guarantee on all systems, with no restocking fee. The system is covered by a 1-year standard parts-and-labor warranty, and you can get a second-year extended warranty for 6.5 percent of the original cost. Tri-Star is sensitive to the fact that many people might be holding off for an even faster 386 or a 486 system. In response to that concern, Tri-Star offers a 1-year full value trade-in for the Flash Cache's system board.

Certainly Tri-Star isn't a big name in the computer industry, but it offers a realistic vision that emphasizes both memory and upgrade issues. If you're looking for a competent 386 machine from a company with a pragmatic outlook, the Flash Cache 386^{33} is worth considering.

FACT FILE

Tri-Star Flash Cache 386^{33}
Tri-Star Computers, 1520 W. Mineral Rd., Tempe, AZ 85283; (602) 838-1222.
List Price: With 4MB RAM, 65MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, $4,995; with 110MB hard disk, VGA monitor, 80387-33 coprocessor, DOS 3.3 or 4.01, $7,114; with 150MB hard disk, 60MB tape drive, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, $8,790.
In Short: Tri-Star Computers shows it knows what 33-MHz computers are all about by offering no systems with less than 4MB of RAM. The Flash Cache 386^{33} comes up with fine performance and attractive pricing, including a 1-year upgrade guarantee with full trade-in credit for the 486 motherboard when it becomes available

CIRCLE 414 ON READER SERVICE CARD

V.I.P.C. COMPUTERS

V.I.P.C.-33 386

by Catherine D. Miller

At $2,999 for a bare-bones machine with 1MB RAM, the V.I.P.C.-33 386 costs a lot less than some comparable 33-MHz units. Even when you add an additional 1.2MB or 1.44MB floppy disk drive, a 100MB hard disk, an additional 3MB RAM, VGA graphics, and DOS, the price tag is only $6,098. That's not much more than you'd pay for many similarly configured 20-MHz 286 machines.

V.I.P.C. doesn't sacrifice quality to gain its price point. Designed around the Micronics motherboard, our $12,499 review unit came in a tower case offering three half-height and two full-height drive bays.

The Micronics board holds an Intel 33-MHz math coprocessor and supplies one 32-bit, five 16-bit, and two 8-bit slots. None of the system memory resides directly on the motherboard; the 32-bit memory board can be configured to hold from 1MB to 16MB RAM. Our review unit's memo-



The V.I.P.C.-33 386 system includes Konan's TenTime TNT-1050 Disk Controller for enhanced disk performance. With 4MB RAM, a 160MB hard disk, 60MB tape backup, VGA, and an 80387 coprocessor, it lists for $12,499.



Made by a third supplier of motherboards, the Micronics design highlights one of the problems in general motherboard architecture. The inclusion of a 32-bit slot for add-on memory has become almost mandatory, yet no designers seem able to agree on what that slot should look like. The Micronics board is found in 33-MHz PCs from Amax, Austin, Bus Computers, FiveStar, PC Brand, and V.I.P.C. Computers.

Price
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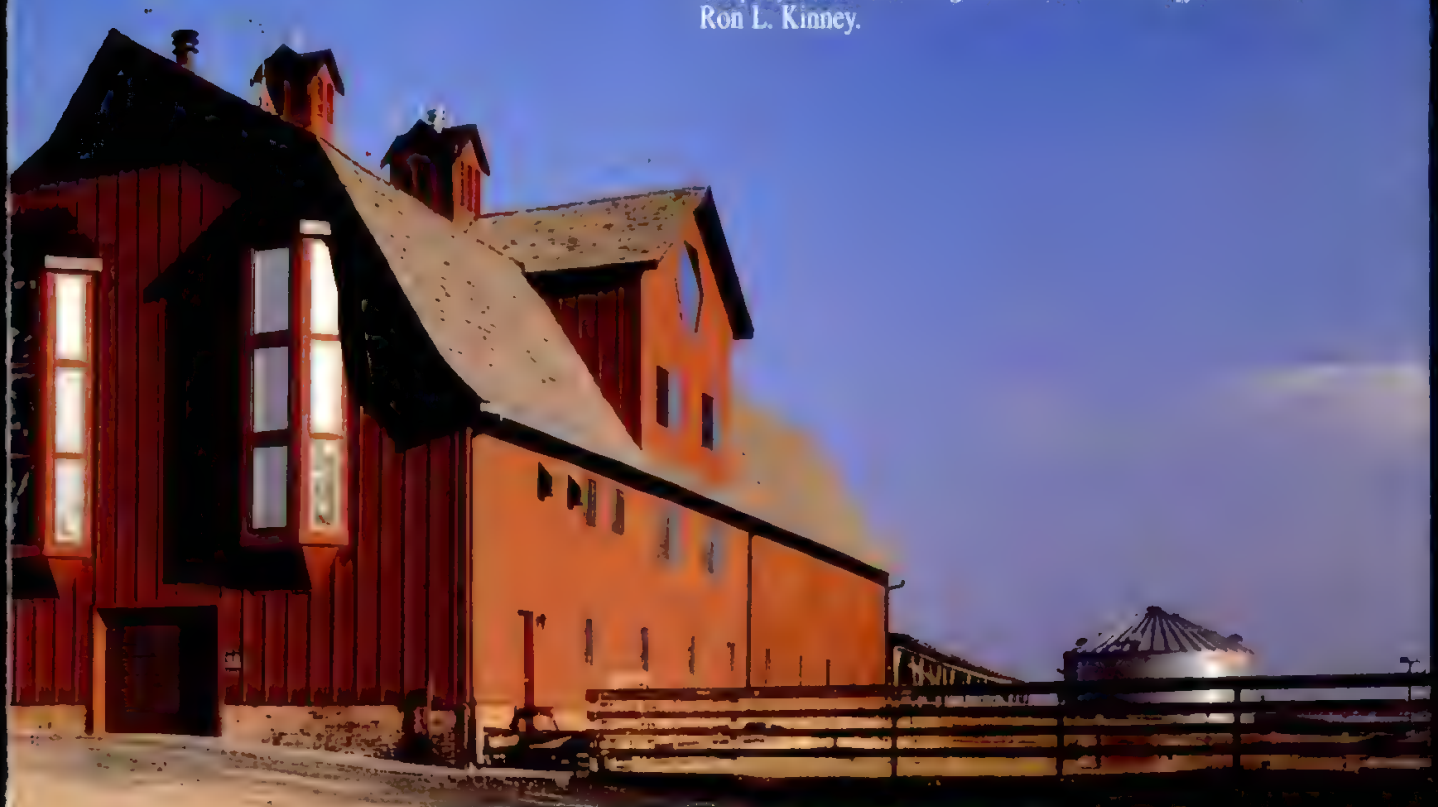
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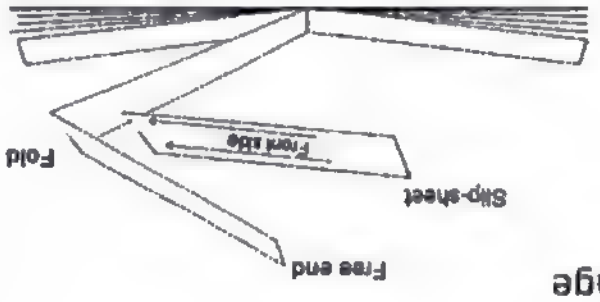
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4. Close the page and slip-sheet



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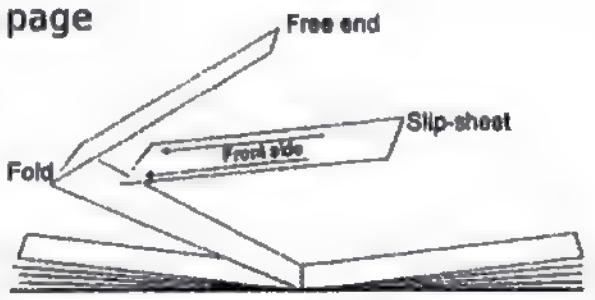
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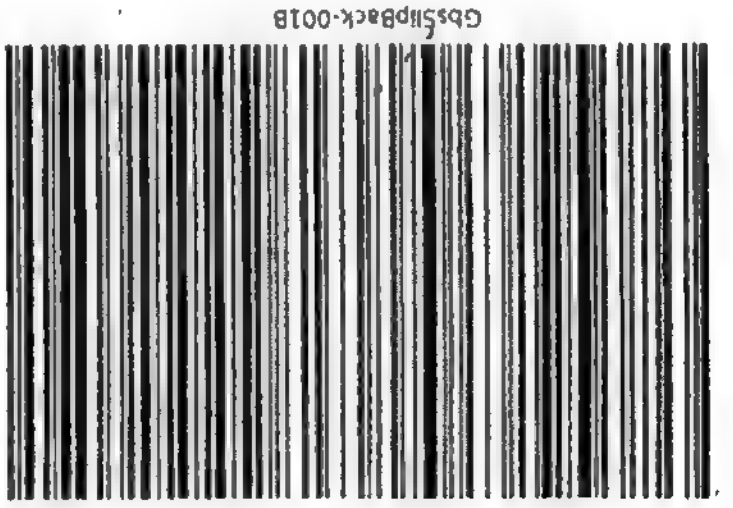
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Back

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CIRCLE 364 ON READER SERVICE CARD

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ry board had 8MB RAM.

Intel's 82385 graphics controller, with 32K of 25-nanosecond cache memory standard, speeds up operations by using direct map cache. An additional 32K SRAM enables two-way set-associative cache operation for improved performance.

While the V.I.P.C.-33 runs at 33 MHz with zero wait states, software-selectable speeds of 6 MHz and 8 MHz make it possible to slow things down. The bus speed can be flipped between 8.25 MHz and 11 MHz by changing DIP-switch settings on the system board. Phoenix chips made up the BIOS, one especially nice feature of which is software-controllable shadow RAM to help improve system and video performance.

The V.I.P.C. fared well in both 80386 Instruction Mix and Floating Point benchmark tests. It was also one of the fastest machines tested in our Conventional Memory benchmark tests.

SPEED RACING

Our review unit was enhanced with Konan Corp.'s TenTime floppy/hard disk controller card. The 16-bit TenTime controller card has a 128K RAM cache that caches both disk reads and writes.

The V.I.P.C.-33's fast performance on the small-record segment of our DOS File Access test may be credited in large part to the decrease in the number of disk accesses resulting from the use of the TenTime board. Its lackluster performance on the large-record portion of the same test was caused by the relatively smaller size of the controller card's RAM cache. At only 128K, the cache can't hold the large records used in the tests; hence the controller wastes time searching the cache for records that aren't there. The V.I.P.C.-33, however, was one of the fastest performers in our BIOS Disk Seek benchmark test.

Mass storage on our review unit included a Maxtor Model XT-2190 160MB hard disk drive rated at 28 milliseconds and a 60MB TEAC streaming tape backup unit. One 25-pin parallel and one 15-pin serial port are supplied by DFI's 8-bit multi-I/O card.

The Paradise 16-bit VGA card, complemented by the Relisys RE5155 multiscanning monitor, supplied good-looking graphics. While the system was one of the fastest performers in the Direct-to-Screen video benchmark test, it was one of the slowest on both video BIOS tests.

The Maxi-Switch and Nan Tan 101-key keyboards were sent with our evaluation unit. The Maxi-Switch was not as clicky as the Nan Tan; if neither meets your expectations, you can ask for a Key Tronic or BTC model.

While V.I.P.C. doesn't offer an on-site contract, it will pay shipping both ways if service is required. While that hassle may be worth consideration, bear in mind that the machine comes stocked with the finest system components available. The relatively low price adds to its attraction for budget-conscious, power-hungry users.

FACT FILE

V.I.P.C.-33 386
V.I.P.C. Computers, 384 Jackson, #1, Hayward, CA 94544; (415) 881-1772.
List Price: With 1MB RAM, $2,999; with 4MB RAM, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, 100MB hard disk, 80387-33 coprocessor, VGA card, multiscanning monitor, DOS 3.3 or 4.01, $6,098; with 8MB RAM, 160MB hard disk, 60MB tape backup, Konan TenTime cache controller, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, 80387-33 coprocessor, tower case, $12,499.
In Short: Designed around the Micronics motherboard, the V.I.P.C.-33 386 offers fast 33-MHz performance at a great price. With the Konan TenTime disk controller, which includes a 128K cache, hard disk performance on two of the three pertinent PC Labs benchmark tests was greatly enhanced.

CIRCLE 415 ON READER SERVICE CARD

WEDGE TECHNOLOGY INC.

Wedge Cache WT386-33C

by Bruce Brown

Wedge Technology's Wedge Cache WT386-33C is an assemblage of stock components that together add up to a respectable machine. The AMI motherboard with its proprietary 386 chip set and BIOS forms the heart of the unit. It is encased within a tower chassis roomy enough to accommodate six half-height storage devices, all of which can use removable media. The power supply is amply equipped to handle the multitude of drives, furnishing a generous 275 watts and six separate device leads.

These advantages are made less appealing by the company's pricing structure.



The Wedge Cache WT386-33C offers standard components and respectable performance for a price that could be lower. It lists for $8,175 with 4MB RAM, a 170MB hard disk, VGA, and an 80387 coprocessor.

The basic Wedge, which includes 1MB RAM, a 1.2MB floppy disk drive, and DOS 4.01, lists at a rather inflated $4,695. A 158MB Maxtor hard disk, 4MB RAM, a 16-bit VGA adapter, a NEC MultiSync 3D VGA monitor, and an 80387-25-MHz coprocessor will set you back $8,175. Compared with $7,899 for a similarly configured Northgate Elegance 386/33 running with a 33-MHz 80387 coprocessor, the price of the Wedge Cache WT386-33C just isn't competitive enough.

If you were getting a lot more bang for the buck, you probably wouldn't quibble at spending the extra dollars. But while the speed differences among all these systems are fairly infinitesimal, the Wedge Cache scored consistently only in the middle of the 33-MHz pack.

WHAT'S IN THE WEDGE

The Intel 80386 processor can run at either 33 MHz with an 8.25-MHz bus speed or at 8 MHz with an 8-MHz expansion bus speed. There are eight slots: one 8-bit, six 16-bit, and one proprietary 32-bit. If you have cards with extra port connectors, you can use them with the eight knockouts on the back of the case.

The motherboard holds up to 8MB of 32-bit RAM and can control another 8MB

on the optional 32-bit memory card. You can use either 256-kilobit or 1-megabit DRAM chips, and there are sockets for either DIP- or SIMM-style chips.

The AMI board offers memory interleaving as well as shadow RAM. The board also has 64K of 20-nanosecond static RAM cache (not expandable), effectively giving the system zero wait state performance on cache hits.

Other components include a Western Digital ESDI hard disk drive, and an interface board with one serial port, one parallel port, and a game port. A Mitsumi 101-key keyboard is the only one offered. This unit is acceptable, being neither particularly mushy nor sharp and clicky.

The test machine sported a 16-bit Paradise VGA board in generic disguise, and a NEC MultiSync 3D monitor. This combination resulted in generally better-than-average video performance times.

A 1-year parts-and-labor warranty is standard. Whether you buy the system through a dealership or order it by mail from Wedge, all service is performed at the company. You pay only the cost of shipping to Wedge. Unlike other companies, however, Wedge returns repaired systems by ground shipment, no matter what method you had originally used. Wedge does offer a 15-day money-back guarantee, but it's subject to a 20 percent restocking fee: even if you bought a barebones unit, you can expect to lose close to $1,000 if you send it back.

The Wedge Cache WT386-33C is an average performer hoping to compete in an already crowded 33-MHz market. With no clear price advantage plus subminimal service and money-back guarantee policies, Wedge Technology may not be able to garner any real market share.

FACT FILE

Wedge Cache WT386-33C
Wedge Technology Inc., 1587 McCandless Dr., Milpitas, CA 95035; (408) 263-9888.
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, DOS 4.01, $4,695; with 4MB RAM, with 158MB hard disk, VGA monitor, 80387-25 coprocessor, $8,175.
In Short: The Wedge Cache WT386-33C is an AMI motherboard-based machine with 64K of cache memory. The components are well chosen and the computer's performance is good, but the price could be lower for this standard-component machine from a little-known company.

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ZENITH DATA SYSTEMS

Zenith Z-386/33

by Alfred Poor

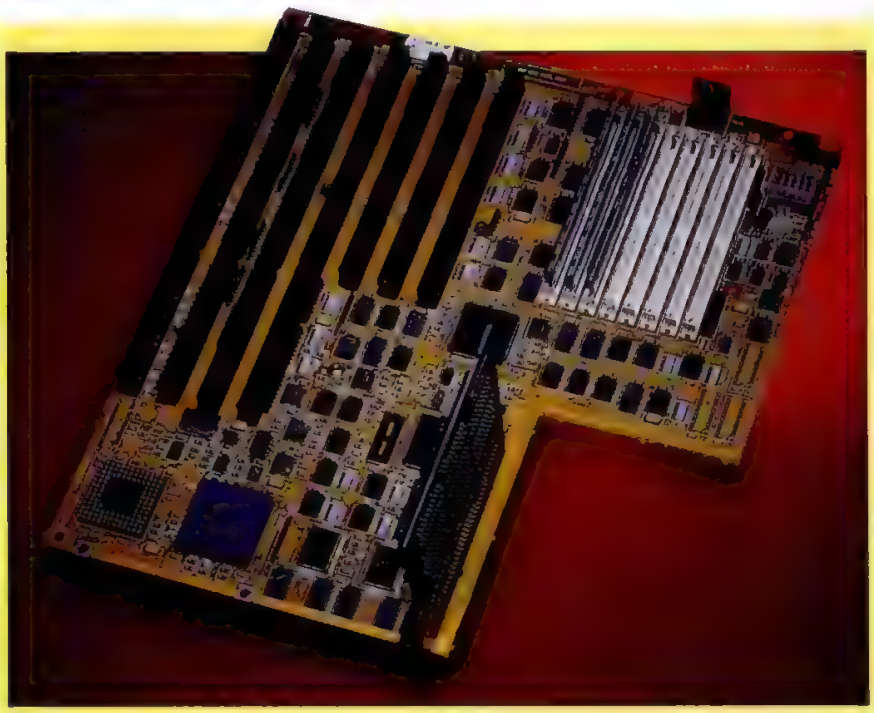
While many 33-MHz machines look as if they were assembled along the same conveyer belt, the Zenith Z-386/33 is something else.

You'll pay $7,999 for a stripped base model, and $14,996 for the reviewed system, with 3MB RAM, a 150MB hard disk, VGA adapter and flat-screen monitor, DOS 3.3 Plus, and *Microsoft Windows*. Obviously, Zenith keeps company with the other high-priced, big-brand names. But unlike many of its competitors, Zenith has added extras that have contributed significant value to the unit.

The case, for example, is no typical clone covering. It has four bezel openings to drive bays (plus room for an enclosed fifth half-height device inside). No need to decide between desktop or tower design here: the desktop case is also designed to slide into a bracket that converts it to a



The Zenith Z-386/33 has a small 16K cache, but its original design yields first-rate results. This well-made machine costs $15,395 with 4MB RAM, a 150MB hard disk, VGA, and an 80387 coprocessor.



Not everything needs to be physically part of the motherboard, as Zenith proves with this 33-MHz motherboard design. Electrical connection is sufficient for its 16K associative cache controller, which juts out of its own unique slot at the side of the board. While Zenith only offers seven expansion slots, four are 32-bit, with the remainder being 16-bit slots.

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Landmark Software v. 1.1 benchmarks — a generalized index used to compare one machine to another. The higher the number the better.

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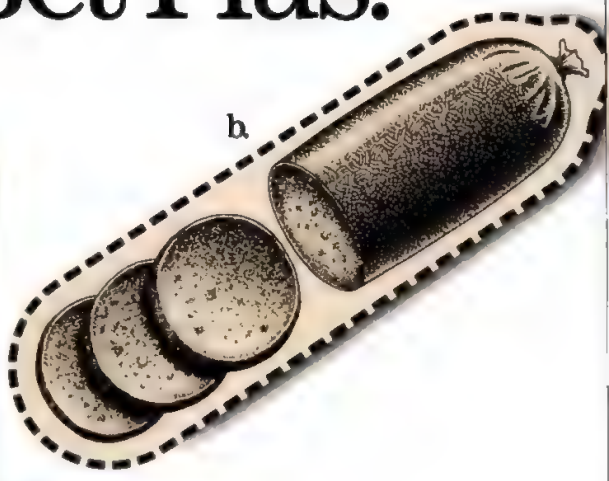
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SIGNS OF CREATIVE THINKING

Inside, you find stronger evidence of original thinking. There are only eight expansion slots: four 16-bit and four 32-bit. The nice part about this is that the 32-bit slots will support 16-bit and 8-bit cards. An extra fan mounted in the front of the case helps keep the card cage cool.

The motherboard handles either 1-megabit (Mb) or 4Mb SIMMs. While it is designed to use 100-nanosecond SIMMs, these machines are usually shipped with 80-ns. chips for an extra margin of safety against heat-related malfunction. (We encountered no problems with our test machine, which included one 100-ns. SIMM and two 80-ns. SIMMs.)

Whereas many designs force you to add SIMMs in sets of two or four, Zenith lets you add them one at a time. You can also add a 32-bit memory expansion card; filled with 1Mb SIMMs, the motherboard and card together give you a full 16MB of RAM. You need 4Mb SIMMs in order to reach the system maximum of 64MB of 32-bit RAM.

Perhaps the most interesting feature of the computer is its memory cache. Zenith's own cache controller comes with an apparently paltry 16K of static RAM, rated at a zippy 15 ns. Despite this small cache, the machine took the top honors in the Floating-Point Calculation benchmark test. The reason for the extra speed is the new 16-layer cache write queue; rather than only buffering memory reads, this design lets the machine hold more data before being forced to write the cache back to the slower system memory. If you happen to decide that you really need a bigger

FACT FILE

Zenith Z-386/33
Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (800) 553-0331, (312) 699-4800.
List Price: With 2MB RAM, 1.44MB 3.5-inch floppy disk drive, DOS 3.3, *Microsoft Windows/386*, $7,999; with 3MB RAM, 150MB hard disk, VGA monitor, 80387-25 coprocessor, $14,996; with 4MB RAM, $15,395.
In Short: Innovative design, conservative specifications, and solid construction create a machine that performs well but isn't fast. Durability is an added value to help Zenith compete against the faster high-end brands in the field.

CIRCLE 417 ON READER SERVICE CARD

EDITOR'S CHOICE

- **Compaq Deskpro 386/33**
- **Northgate Elegance 386/33**

For anyone interested in a 386 running at 33 MHz, the most important factor is performance. In fact, the margin that separates the fastest from the slowest machines is so small that you can't go wrong with the majority of machines here.

Four machines, however, distinguished themselves as the fastest: the Northgate, ALR, Compaq, and Everex. All four have gone a step beyond the usual Intel, Mylex, and AMI motherboard designs in favor of their own, and this extra engineering sets them apart.

In a class by itself is the Compaq Deskpro 386/33—possibly the finest personal computer Compaq has produced to date, albeit the most expensive. Our standard-configuration machine with 4MB RAM, VGA, and an 80387-33 math coprocessor has a list price over $18,000 before figuring in the 30 percent discount that comes from not ordering direct, as you do with Northgate. That price also includes a 320MB ESDI hard disk, the next standard disk option Compaq offers after its 84MB hard disk and well above the 100MB hard disk we specified for our standard configuration. Despite the price tag, the Deskpro is the most versatile PC in this roundup, offering simultaneous support of both a Weitek 3167 and an Intel 80387-33, up to 1.3 gigabytes of internal mass storage, and 32-bit RAM memory expansion up to 16MB.

On top of all this, with 16-bit VGA circuitry integrated on the motherboard, the Deskpro screamed its way through the PC Labs video benchmark tests. While motherboard-bound VGA capability ordinarily discourages upgrades to Super-VGA-quality graphics, Compaq's circuitry compensates by supporting the company's Advanced Graphics system, a dedicated, interlaced graphics scheme that supplies 256 simultaneous colors in 1,024-by 768-pixel resolution. Compaq's ESDI hard disk controller (running at 15 MHz) plus a 300-watt power supply make the Deskpro 386/33 the best available PC for file-serving, graphical, and intensive disk- and processor-based applications. Just plan your expansion plans carefully—Compaq's Fixed Disk Expansion Unit sells for a prohibitive $6,399.

Price should not be a compelling factor when performance is at stake. But neither can it be ignored—and with the Northgate Elegance 386/33, it isn't. For $7,899, you get 4MB RAM, a 150MB ESDI hard disk, a Princeton Graphic Systems VGA monitor, an 80387-33, and DOS 4.01. This first-rate system includes the usual Northgate amenities: 1 year of on-site service, overnight shipment of replacement parts, of excellent documentation and support, plus an OmniKey keyboard.

The Elegance 386/33 also demonstrated the fastest processor time of the pack, which is largely due to the engineering behind Northgate's 64K write-back cache. For even faster performance, the cache is expandable up to 256K. Since Northgate does not shadow ROM BIOS in RAM, 384K of memory remains available. This practice makes the performance results of the Elegance 386/33 even more impressive.

One word of advice: the Video Seven VGA card in the Elegance 386/33 was not exceptionally fast. Alternatively, consider another VGA adapter from Northgate.

Honorable mentions go to the Everex Step 386/33 and the ALR FlexCache 33/386. These two machines are dedicated to speed and are among the fastest CPU performers. ALR and Everex, respectively, give you 4MB RAM, VGA, and an 80387-33 for $11,666 (150MB hard disk) and $11,342 (160MB hard disk).

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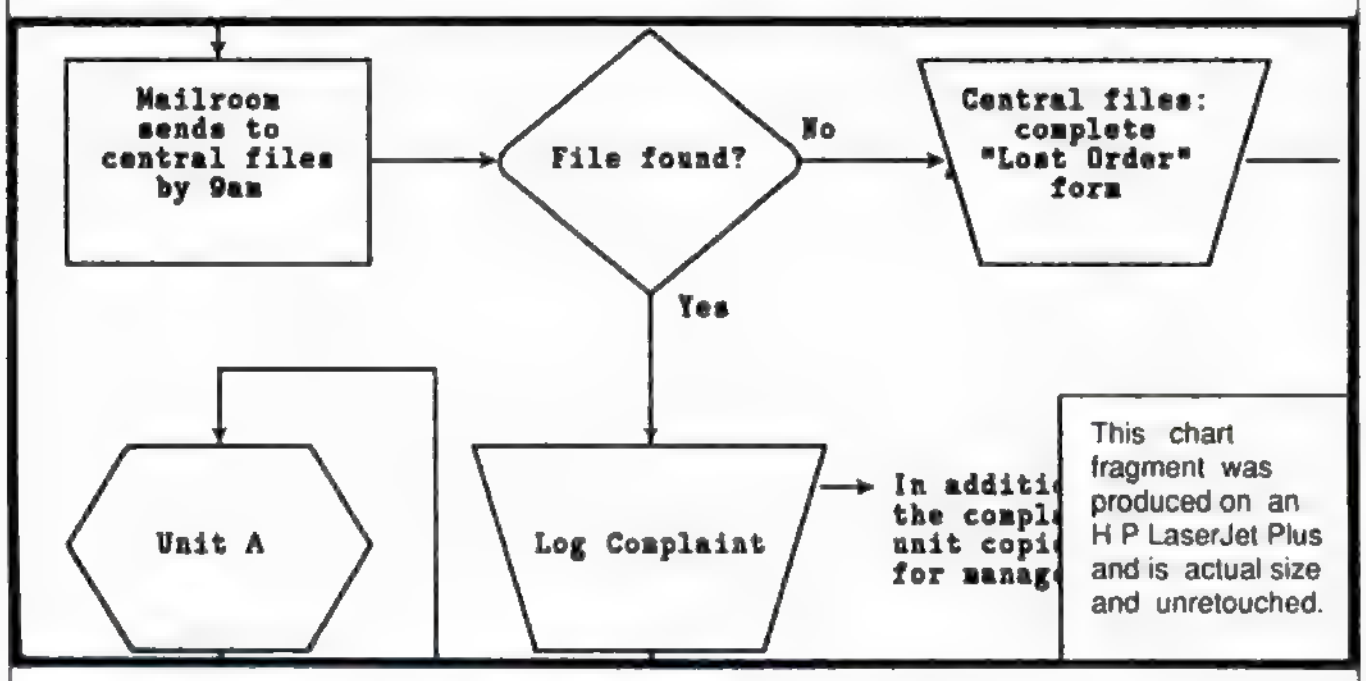
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cache, expand it to a full megabyte.

You also get the DTC ESDI hard disk controller. The unit supplies on-board disk caching to boost hard disk performance: the Zenith ranked seventh-fastest on our BIOS Disk Seek tests.

SOFTWARE EXTRAS

Zenith's version of DOS—DOS 3.3 Plus—includes a collection of handy extensions and utilities, such as a hard disk compacting program that eliminates file fragmentation and improves performance. You also get Zenith's *Monitor* program in ROM, which allows having access to the system configuration, poking around memory, and generally getting at other technical items. For the security-minded, the ROM setup program lets you implement a password before system boot-up.

A few minor complaints include a

The Zenith Z-386/33 is thoughtfully designed, and loaded with extras that make it both fast and useful, most noticeably Zenith's innovative memory cache scheme.

mushy keyboard with little tactile feedback, a tiny power switch stuck far away in the back of the case, and a somewhat skimpy standard warranty. You can choose either a full-year policy covering parts and labor or convert it to 3 months of free on-site coverage. Other warranty options are available at extra cost.

The Zenith Z-386/33 is well built, thoughtfully designed, and loaded with extras that make it both fast and useful. If you are not stuck at the bottom of the price scale, or if you are required to limit your search to top brand names, then make sure to put the Zenith on your list. ■

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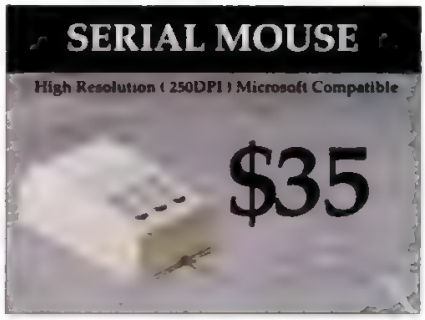
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PHOTOGRAPHS: JOHN LEI

Easier to learn than C or Pascal, BASIC is ultimately more powerful in many ways. This review of ten systems—from simple interpreters to sophisticated compilers—reveals how far BASIC has come from its humble beginnings.

by Ethan Winer

For many people, the first exposure to programming is with the BASIC interpreter that comes bundled with DOS. Because it is included at no extra cost, BASIC (Beginner's All-purpose Symbolic Instruction Code) is known and used by more people than any other programming language for personal computers. And no other PC language has grown as much as BASIC in recent years, both in popularity and capabilities.

With the introduction of sophisticated compilers from Microsoft and several other companies, BASIC in many ways is now more powerful than even C or Pascal. It offers, for example, more built-in commands than any other language, including powerful graphics, music and sound, and complete support for interrupt-driven communications—while remaining much easier to learn.

Nonetheless, BASIC has been the target of much unfair and abusive criticism in recent years, with partisans of other languages claiming that it is a "toy" language that encourages poor programming habits. Such a generalization is unfortunate, because the current generation of BASIC compilers are very serious products that fully exploit the capabilities of the PC. Many commercial pack-

ages are written in compiled BASIC, among them a number of communication programs.

HUMBLE BEGINNINGS

BASIC was developed at Dartmouth College in 1964 by John G. Kemeny and Thomas E. Kurtz. From the start it was designed to introduce beginners to programming concepts but shield them from the intricacies of the computer's internal operation. What made BASIC so revolutionary for its time, however, was that it interpreted each instruction while a program ran.

The purpose of any computer language is to translate a program's source code into commands the computer's microprocessor can actually execute. With a compiled language, the source text is generally created with an editor, saved to disk, and then processed—that is, completely translated—by the compiler before it is run. If the compiler detects any errors (for example, in syntax), the programmer must restart the editor, load the source program, and go through the process all over again.

Contrast this with the original BASIC interpreter, in which programs may be created and run directly from within the editor. Syntax errors are detected as each BASIC statement is entered, and runtime errors (such as an attempt to divide a value by zero) are reported while the program is still in the editor. This immediate feedback—coupled with simple, English-like commands—quickly helped to establish BASIC as the easiest language to learn and use.

Interpreted BASIC, however, is not without failings. To begin with, each instruction must be deciphered at the time the BASIC program runs, which takes a fair amount of time. If a given BASIC instruction is executed, say, 20 times, the interpreter will have to translate it that many times. Two other important limitations are that each program statement must be sequentially numbered, and there is no way to establish program variables as private to a given procedure.

Of course, in many situations it doesn't really matter if a program runs at the highest possible speed. Who cares, after all, if it takes 1 millisecond or 50 to print the message "Press any key" to the screen? And programs that frequently access a disk are often limited more by the speed of the disk drive hardware than by that of the language. Furthermore, careful planning can minimize the need for private procedures

What made BASIC so revolutionary for its time was that it interpreted each instruction while a program ran—offering immediate feedback.

and local variables (features previously available only in C and Pascal) in all but the largest programs.

THE BASICS OF BASIC

All programming languages embody two important elements. The first is the program itself, which consists of statements and instructions that tell the PC what actions it is to perform. A program, for example, might print a message on-screen that asks the operator to enter a customer's name. Once such a message has been displayed, another instruction might be to accept user input from the keyboard until the Enter key has been pressed. Other instructions could then create a disk file and store the name that was entered in that file.

The second element in a computer program is the data that is to be acted upon. This data can consist of either numeric values or text. Examples of numeric data are dollar amounts, the number of records in a file, or a temperature measurement. In BASIC, text data is referred to as strings, which consist of information such as names, addresses, and other alphanumeric characters.

Most versions of BASIC support several types of numeric and string data. Microsoft's QuickBASIC 4.5, for example, offers integer and long integer whole numbers, as well as two types of floating-point numbers. An integer can hold any value between −32,768 and +32,767, while a long integer can range from −2,147,483,648 to +2,147,483,647. The two types of floating-point numbers are referred to as single-precision and double-precision, and their values can range between approximately plus or minus 3.37E+38 (in other words, 3.37×10^{38}) and plus or minus 1.67E+308. String data under QuickBASIC 4.5 can be of either fixed or varying length, and any single string can have a length of up to 32,767 characters.

There are two primary reasons for offering more than one type of numeric data. One consideration is the amount of computer memory required to hold each value. In many programming situations, very large (or very small) numbers are not necessary, and integers occupying only 2 bytes of memory will be sufficient. Integers are also the only numeric type native to the 8088/80286 series of microprocessors, thus allowing calculations to be performed extremely quickly.

Long integers require 4 bytes each, as do single-precision values. For each double-precision number used in a program, 8 bytes of memory will be needed. However, to obtain the wide range of values supported by single- and double-precision numbers, a complicated system is employed. Therefore, the second reason that BASIC offers more than one numeric data type is because of the time required to manipulate floating-point values.

VARIABLE VERSATILITY

Before we look at some sample BASIC programs, there is one more important concept to understand: variables. Unlike the simple memory feature of a four-function pocket calculator, a BASIC program can remember nearly any number of text or numeric entities. The programmer simply makes up a name for each variable, whose contents may then be stored and retrieved when needed.

Now let's take a look at a simple BASIC program that first asks you to enter your age, and then tells you how old you will be in the year 2000:

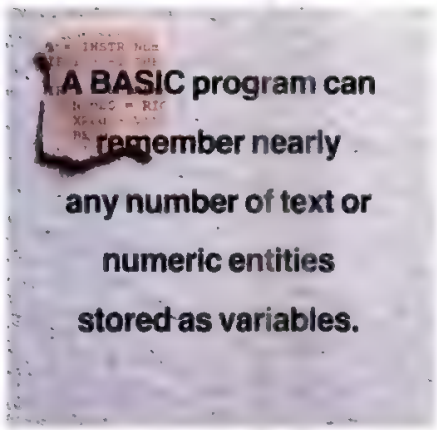
```
CLS
PRINT "Please enter your age";
INPUT Age
NewAge = Age + 11
PRINT "In the year 2000 you will
 be"; NewAge; "years old."
```

Even though this is obviously a very fundamental calculation, the concepts employed here can be extended to programs of nearly any complexity. As you can see by examining the program listing, only

five instructions are required.

The first command is CLS, which tells BASIC to clear the screen. This is exactly the same as DOS's own CLS command, and it is used merely to ensure that any messages or extraneous information from an earlier program is erased. CLS also locates the cursor at the upper-left corner of the screen.

The second instruction prints the message "Please enter your age" on the screen, so the person running the program knows what he is supposed to do. The third command instructs BASIC to accept numbers as input from the keyboard until Enter is pressed. After the number has been entered, its value will be stored by BASIC in the variable named Age. Again, nearly



any variable name may be used, although it makes sense to use one that is descriptive and thus easy to remember.

Once a number has been entered and stored in the variable Age, the fourth instruction is used to add the value 11 to it and place the result of this addition into another variable named NewAge. The final BASIC command prints both a text message and the answer in one operation.

Because it is so common to preface an INPUT command with a prompting message, BASIC also offers a way to combine both operations into a single command. This is shown in context below:

```
INPUT "This is a prompt", Variable
```

In this case, the message "This is a prompt" is displayed; BASIC then waits for a number to be entered at the keyboard. As you can see, the instructions in a BASIC program are always performed in sequence, and variables may be assigned and retrieved as needed.

FLOW CONTROL

In a program this simple, only a few instructions are being performed, and the order in which they're executed is easy to establish. But this brings us to another important BASIC programming concept: flow control.

In some situations, you may want to perform different actions, based on the information that was entered. If someone claims to be 400 years old, for example, you probably want to ask him to enter his age again, as shown here:

```
CLS
INPUT "Please enter your age", Age
IF Age > 100 OR Age < 1 THEN
 BEEP
PRINT "I don't believe you!"
ELSE
     NewAge = Age + 11
PRINT "In the year 2000 you
 will be"; Age + 11
END IF
```

In this example, the IF command is used to test whether the age that was entered is greater than 100 or less than 1. If either of these is true, the program will first beep the speaker, and then print "I don't believe you!" Otherwise, the statements that follow the ELSE statement will be executed. The END IF clause merely identifies the group of instructions that are being controlled by the IF and ELSE tests. Notice that besides combining the effects of PRINT and INPUT, this example includes the numerical calculation within the PRINT statement.

Of course, BASIC also allows very complex expressions to be tested. Besides the IF test shown in the second example, BASIC supports a number of other flow-control constructs. Two of these are DO WHILE and LOOP, and FOR and NEXT. DO WHILE tells BASIC to continue to execute a group of instructions while a given condition is true, and FOR lets you specify that something is to be done a certain number of times. These are shown in context here:

```
DO WHILE TIME$ < "11:00:00"
     PRINT "It's not 11 AM yet."
LOOP

FOR X = 1 TO 10
     PRINT X
NEXT
```

In the first example, while the current PC system time remains less than 11:00:00, the message "It's not 11 AM yet." will be continuously printed. The second example shows a FOR/NEXT loop that tells BASIC to print the count held in the variable X ten times. That is, all of the values between 1 and 10 inclusive will be printed on the screen. The words FOR and TO along with the variable X are really shorthand for the expression "FOR every value that X EQUALS within the range from 1 TO 10 do the following."

BASICALLY SUPERIOR

BASIC is very logical, as you can see from these few short examples. Its use of easily understandable commands, in fact, allows anyone with the interest and the time to start writing real programs that perform useful tasks.

Where BASIC really shines, however, is in its wealth of powerful features; just because BASIC is easy to use does not mean that it lacks capability. BASIC, for instance, can read and write to any memory location, directly access the processor's I/O ports, and manipulate network data files.

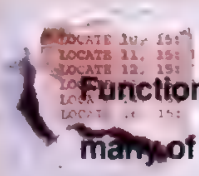
Among the more important advantages BASIC holds over languages like C and Pascal is variable-length strings. Where other languages force you to set aside a fixed amount of memory for each text string at the time a program is written, BASIC allows the length of a string to be established when the program runs. Furthermore, any string may be reduced or extended as needed, to accommodate any length required.

Equally important are BASIC's powerful graphics commands. Modern BASIC compilers like Microsoft's QuickBASIC and Turbo Basic support all the PC's video modes, and commands are provided to draw lines and boxes or circles and arcs, with manual or automatic scaling. The PC Lab Notes column "Advanced Graphics in BASIC" (*PC Magazine*, June 14, 1988) shows how to write elaborate three-dimensional business graphs in BASIC, along with a discussion of tiling and animation techniques.

Other BASIC advantages include dynamic arrays, access to the PC's timer, interrupt-driven event handling, and full support for communications. For example, to open a communications port at 1,200 bits per second with no parity, 8 data bits, and 1 stop bit is as simple as typing OPEN "COM1:1200,N,8,1". To create

BUILDING ON THE BASIC FOUNDATION

by Dean Hannotte



Function libraries, many of which are written in assembler, boost the power of BASIC to handle traditional applications.

In case you need even more evidence that BASIC is not just a language for children and college professors, you'll be surprised to learn that a number of serious add-on packages can make it easy and even fun to add professional touches to your programs. Since many of these function libraries are written in assembly language, you can now give your BASIC applications the same speed advantages that demons like *Lotus 1-2-3* have and the same user-friendliness that Microsoft QuickBASIC 4.5 itself has.

Here's a roundup of some of the more powerful tools now available.

GENERAL FUNCTIONS

On the general side, *QuickPak* from Crescent Software (11 Grandview Ave., Stamford, CT 06905; (203) 846-2500) is a $79 collection of over 70 routines. It supports windowing, DOS and BIOS services, string searching and sorting, data encryption, pull-down and Lotus-style menus, data input, and more. *QuickPak* includes sample programs, full source code (as do all Crescent products), and a tutorial on assembly language.

QuickPak Professional, also from Crescent, includes all of *QuickPak*'s routines and many more. Its more than 300 routines offer file and printer services, date and time arithmetic, mouse support, screen dumping from any video mode to either an Epson- or LaserJet-compatible printer, and a comprehensive set of scientific and financial functions. Sophisticated window handling supports ten levels of nesting. In addition, the many demonstration programs include a full spreadsheet application, a full-screen editor, a pop-up calendar, and a file browser.

On the subject of libraries, Hammerly Computer Services (9309 Jasmine Ct., Laurel, MD 20707; (301) 953-2191) offers *ProBas Professional BASIC Programming Library*, Version 2.0, a $99 all-purpose collection of 232 relatively low-level assembler routines that can make your programs faster and your programming easier. Its equipment-handling routines, for example, give information on the following topics: processor and coprocessor, amount of memory (base, extended, and expanded), DOS version, disk capacity and available space, type of display, video mode, ports, and mouse information. The six hundred pages of documentation discuss in great depth the history and anomalies of the various QuickBASIC versions and indicate which *ProBas* routines require strict IBM compatibility and which will work on a clone.

If you find the *ProBas* routines too low-level, you can opt for the *ProBas Toolkit*, a $99 collection of plug-in menu generators, input routines, mini-text editors, and B-tree index routines. The TeleComm utility offers Xmodem and Ymodem support, terminal emulations, auto-dialers, and more, while ProScreen lets you generate and edit screens.

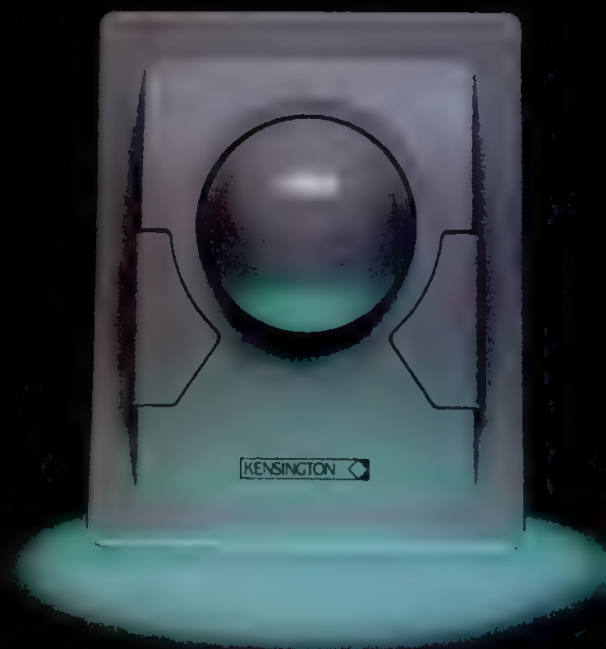
Also in the all-purpose category is *Finally! A Subroutine Library for Compiled BASIC*, a $99 collection of 150 subprograms and functions from Komputerwerk (851 Parkview Blvd., Pittsburgh, PA 15215; (800) 423-3400, (412)782-0384), only a few of which are written in assembly language. These perform date and time conversion; file and directory control; chart drawing; keyboard, screen, and printer control; number conversion and math functions; string handling; and data sorting. If that isn't enough to satisfy you, for $99 more you can get *Finally! Modules*, which generates Microsoft-style pull-down windows, Lotus-style horizontal menus, pop-up help screens, and a directory manager.

There's also the *EXIM Toolkit* from EXIM Services of N.A. (P.O. Box 5417, Clinton, NJ 08809; (201) 735-7640). The $149.95 Standard Version of *EXIM* includes a pop-up text editor with block-edit operations and the DDS tool, which lets you define fields of data in an external file and then reference them by name without regard to location. Other tools include a clipboard, menuing system, on-line help, and screen management utility. Other versions are *NetWorks* and *Genesis;* these list for $249.95 each and include the Standard Version. Perhaps the most elaborately packaged collection of general-purpose functions, however, comes from MicroHelp (4636 Huntridge Dr., Roswell, GA 30075; (404) 552-0565, (800) 922-3383 (orders)) and is packaged in the following volumes:

- *Mach 2* ($79)—fast assembler routines for table sorting, file and directory services, data entry, and video control;
- *Stay-Res Plus* ($89)—allows you to write terminate-and-stay-resident programs in BASIC that pop up either when a hotkey is pressed, at a specified time, or when another user dials your computer;
- *MicroHelp Toolbox* ($79)—plug-in subprograms and functions in BASIC source format that generate Lotus-style and pull-down menus and exploding dialog boxes, as well as line, full-screen, and spreadsheet-cell data input;
- *QB/Pro 1* ($89)—superfast routines for the manipulation of arrays (double-precision, long integer, integer, and string); display routines; and file, directory, and volume management;
- *QB/Pro 2* ($89)—more fast routines for number and string manipulation,

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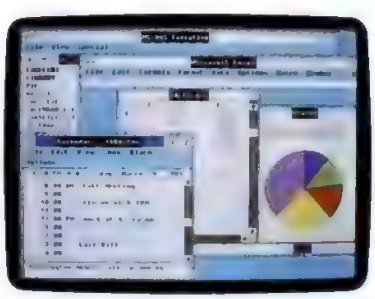
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it's so hard to find wh



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And you're certainly not about to search through each directory, much less load and unload every file to find it.

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[1]Applications supported in SpeedView include Lotus 1-2-3, Symphony®, Manuscript®, Agenda®, WordPerfect, dBase®, MultiMate®, Microsoft® Word, WordStar®, DisplayWrite, all ASCII files, plus many more.

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they appear in your favorite applications.

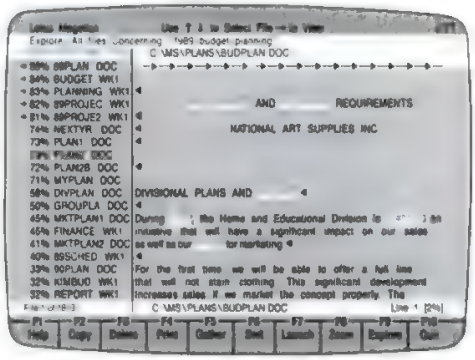
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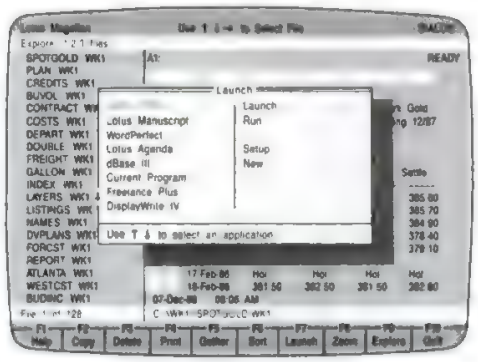


The Magellan Explore and SpeedView functions let you locate everything related to a particular topic and see it as it would appear in its native application.

Using the information is easiest of all. Because all it takes is one keystroke to launch into the application that created the file, and it'll be loaded and ready to go.

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Introducing Lotus Magellan

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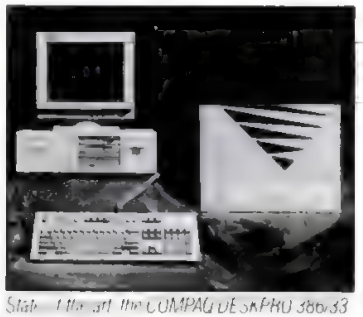
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Steve Koss, MIS project manager, Oakland Coliseum.



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BUILDING ON BASIC (continued)

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Newly released is Crescent's *P.D.Q.*, a $99 replacement library for Microsoft QuickBASIC that allows programmers to create extremely small (700-byte minimum) .EXE programs and TSRs.

COMMUNICATIONS

Beyond the capabilities of *ProBas Toolkit*'s TeleComm utility is *QuickComm*, a high-level communications library from Software Interphase (5 Bradley St., #113, Providence, RI 02908; (401) 274-5465). Designed for users of Microsoft BASIC Compiler or QuickBASIC, *QuickComm* allows programmers to write applications using up to 16 serial ports simultaneously. The *Quickcommm* package includes support for Hayes-compatible modems (such as those offering dialing and auto-answer); XON/XOFF and CTS/RTS software and hardware flow control; and Xmodem, Ymodem, and Ymodem-batch file transfer protocols—all handy features.

MANAGING YOUR DATABASE

QBase from Crescent is a complete relational database. Priced at $149, it comes with a file-rebuilding program, a help window demo, sample screens and applications, and a slide show program that lets you display a series of screens automatically. *QBase* includes a humorous tutorial on electronic circuitry written from a programmer's perspective.

db/LIB, a $139 package for QuickBASIC 4.0 from AJS Publishing, goes one step further, letting you read and write standard *dBASE III Plus* database (.DBF), index (.NDX), and memo (.DBT) files. In addition, routines are provided that replicate *dBASE*'s familiar Browse, Edit, Create, List, Report, Append, Copy, Global Update and Index functions.

SCIENTIFIC FUNCTIONS

QuickPak Scientific from Crescent Software is a $79 collection of functions and subprograms designed for scientists and engineers. The package's components solve linear algebraic and differential equations, perform numerical integration and differentiation of functions, find roots, fit curves, and handle function minimization and maximization.

UNBUNDLED SCREEN GENERATION

Crescent Software's *Quick Screen*, a $99 full-screen interactive application, lets you define data entry fields and create custom help screens. Rather than generating code, *Quick Screen* compresses and saves the screens and fields as form definitions to be loaded at runtime.

GRAPHICS SUBPROGRAMS

Finally! XGraf ($125) from Komputerwerk provides transparent support through almost 100 called functions for all graphics modes of CGA, EGA, and VGA, as well as for Hercules display adapters. Unfortunately, *Finally! XGraf* requires an additional royalty for commercial use.

GraphPak from Crescent Software is a $79 collection of subprograms for displaying 3-D bar, pie, and line graphs. All popular monitors are supported and detected automatically at runtime. The $149 *GraphPak Professional* adds business and scientific graphs, surface plots, multiple fonts, and quick text-based bar charts. Also included is a graphics screen dump program for Epson- and LaserJet-compatible computers.

GeoGraf Personal Edition from GeoComp Corp. (66 Commonwealth Ave., Concord, MA 01742; (800) 822-2669, (508) 369-8304) is a software graphics library for Microsoft QuickBASIC that can be invoked to generate plots on the screen, printer, and plotter. Thirteen different fonts are generated as vectors, which allow characters of any size at any location or angle on any of the supported graphics devices. The plotting commands can be stored on-disk and output later with a supplied utility. There is also a *GeoGraf Professional Edition*, which contains extensions to the basic product.

DOING WINDOWS

DiaLogic from Crescent Software provides subprograms for adding versatile dialog boxes to a QuickBASIC program. With dialog boxes fashioned after those used in QuickBASIC and *Microsoft Windows*, *DiaLogic*'s features include full mouse support, scrolling input boxes, check boxes, list boxes, option buttons, and "smart labels." *DiaLogic*'s polling mode, additionally, allows the BASIC programmer to simulate multitasking in an application by displaying multiple dialog boxes and requesting that the user press a key or mouse button.

For another way to give your application the sort of junior-SAA "look and feel" exemplified by the *Norton On-Line Programmer's Guides* or the QuickBASIC compiler itself, take a look at *QuickWindows Advanced*, a $139 window-management library from Software Interphase. Written for QuickBASIC 2.0 or later or BASCOM (BASIC Compiler) 5.36 or later, this library generates windows, pop-up and pull-down menus, and dialog and message boxes; it also provides mouse support. The dialog boxes can sport radio buttons, check boxes, list boxes, input boxes, range bars, and push buttons. The result? Your application will look remarkably like something only Microsoft could do. ■

Editor's note: To avoid a conflict of interest, contributing editor Ethan Winer, the president of Crescent Software (one of several companies discussed here), has deferred involvement in the preparation of this sidebar.

CALLING OS/2 FUNCTIONS FROM BASIC

by Don Malin

OS/2 offers a number of real advantages over DOS for programmers, such as multitasking and support for extended memory. But one of the truly great features of OS/2 is the ease with which its functions can be called from a high-level language. Under DOS, you must either write the routine entirely in assembly language or put up with BASIC's clumsy CALL INTERRUPT. OS/2, instead, allows access to system services by name, and any necessary parameters are passed in much the same way as they are in a regular BASIC function. Currently, however, only Microsoft BASIC 6.0 can be used for OS/2 programming.

Regardless of which OS/2 function is going to be called, you must know which parameters are expected and in what order. (For information on OS/2 services, you can consult the IBM and Microsoft manuals, or choose from several popular books, including Peter Norton's *Inside OS/2*, Ray Duncan's *Advanced OS/2 Programming*, and Ed Iacobucci's *OS/2 Programmer's Guide*.) Notice that OS/2 functions are true functions, not simply subroutine calls. Therefore, you must declare them as functions in the BASIC program and invoke them as part of an assignment. The value returned will be either zero if no error occurred or an error code indicating what went wrong.

The program in Figure A shows how to determine the current directory for any specified drive using the DosQCurDir (DOS Current Directory) service. The BASIC CurPath$ function is merely a "wrapper" to handle the actual OS/2 call. The main program begins by prompting for the drive to be queried and then prints the current directory for that drive.

DosQCurDir expects three parameters to be passed to it, the first of which is a number indicating the drive to report on. If this number is 0, then the current drive will be used; likewise, 1 indicates drive A, 2 drive B, and so forth. (If, for example, drive A is also the current drive, 0 or 1 are both acceptable parameters.) DosQCurDir expects the actual value of the drive number, as opposed to an address, which is BASIC's default method of parameter passing. Therefore, we must use the BYVAL keyword shown in the function declaration.

The second parameter is a string that must already be assigned a sufficient number of characters to hold the returned directory name. Currently, OS/2 has the same 64-character limit for path names as does DOS. This limit, however, may be expanded in a future version, which is why 128 bytes are set aside for this function. BASIC also uses a unique method for storing strings that somewhat complicates passing them to an OS/2 routine: OS/2 expects both the segment and address of the string data, as opposed to the address of a BASIC string descriptor. Thus, we must use both VARSEG and SADD (String ADDress) when sending a BASIC string to an OS/2 function.

The last parameter tells DosQCurDir the length of the string being sent to it. If the string is too short, the function will return an error code and also assign the variable to the required length. This way, we can call DosQCurDir again with a string set to the right length.

In general, any OS/2 parameters that will be modified by a function must be passed as a segmented address, while parameters that will be read only by the routine are passed by value. By default, BASIC passes only the address of a variable; therefore, it is always necessary to use either BYVAL or SEG when calling an OS/2 service.

While this program illustrates the calling method for only one of hundreds of OS/2 functions, the general conventions shown here apply to all of them. Unlike DOS, which, from a programmer's perspective, is at best a difficult operating system to deal with, OS/2 can serve as a very useful and natural extension to the BASIC language, as this example plainly shows. ■

COMPLETE LISTING

```
****** CURPATH.BAS

'Copyright (c) 1988, Ziff Communications Co.
'PC Magazine * Don Malin
'Queries the current directory in OS/2

DEFINT A-Z                                                    'Default to integers

DECLARE FUNCTION DosQCurDir%(BYVAL Drive, BYVAL StrSeg, BYVAL StrOff, _
    SEG Length)

DECLARE FUNCTION CurPath$(Drive$)                          'BASIC wrapper for OS/2 call

INPUT "Which drive (ENTER for current drive)"; Drive$          'ask for drive to check
PRINT "The current directory is "; CurPath$(Drive$)              'print the directory

FUNCTION CurPath$(Drive$) STATIC

    IF LEN(Drive$) THEN                                       'Was a drive letter given?
    DriveNumber = ASC(UCASE$(Drive$)) - 64                  'Yes, convert to drive number
    ELSE
    DriveNumber = 0                                           'No, use the current drive
    END IF

    BufLen = 128                                             'OS/2 needs buffer's length
    Path$ = Space$(BufLen)                                   'Buffer to receive the name
                                                                'invoke the function
DOSError = DosQCurDir%(DriveNumber, VARSEG(Path$), SADD(Path$), BufLen)

    IF DOSError THEN                                           'Show there was an error
    CurPath$ = "Error" + STR$(DOSError)                     'Append the OS/2 error number
    ELSE                                                     'Return what precedes CHR$(0)
    CurPath$ = "\" + LEFT$(Path$, INSTR(Path$, CHR$(0)) - 1)
    END IF

END FUNCTION
```

Figure A: While the above BASIC program illustrates the calling method for only one of hundreds of OS/2 functions, the general conventions shown apply to all of them. The BASIC CurPath$ function, here, is merely a "wrapper" to handle the actual OS/2 call; the main program begins by prompting for the drive to be queried and then prints the current directory for that drive.

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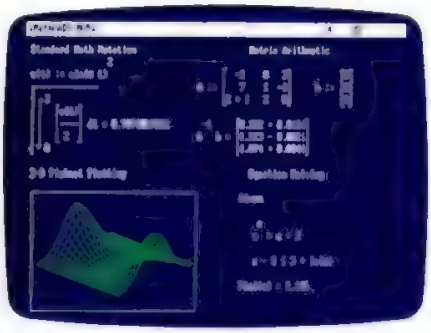
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CIRCLE 154 ON READER SERVICE CARD

the equivalent of this one BASIC statement using C would require hundreds of lines of code or the purchase of an add-on library.

ENHANCING BASIC

As with any high-level language, the performance and code size of a BASIC program can always be improved with the addition of external routines written in assembly language. It's no secret that the best way to produce fast screen updates is by using an assembler routine that writes directly to video memory. Moreover, programs to perform such common operations as sorting and searching data will be much faster when they are written in the processor's native language. Therefore, BASIC provides an easy way to interface assembler routines with the CALL command.

Because assembly language is admittedly the most difficult language to write in, many BASIC programmers turn to third-party suppliers for add-on libraries and toolboxes. A number of vendors also offer prewritten BASIC routines that would be difficult or time-consuming for most programmers to create by themselves. A sampling of assembler and other toolbox products is listed in the sidebar "Building on the BASIC Foundation." Besides providing ready-made solutions to common programming problems, a well-written toolbox package can also be an excellent way to learn about programming in assembler.

TESTING BASIC LANGUAGES

There are a number of factors to consider in choosing BASIC as your programming language, and the pros and cons no longer rest on the structural inflexibility and dogged performance that plagued the language through its early years.

With the introduction of compilers from Borland and Microsoft, BASIC can achieve respectable performance levels. The graphic enhancements to QuickBASIC 4.5 alone move this dialect out of the realm of faster GW-BASIC clones and into a language segment all its own.

Of course, compilers aren't the only game in town. The pack is rounded out with p-code (pseudocode) generators like True BASIC that compile your program when you want to run it, optimizers that examine your code and ignore lines that have no impact on the process, and even slower interpreters that augment or add to the list of existing GW-BASIC capabilities. Overall, any dialect of BASIC provides you with an easy access to program creation, in most cases using commands you are likely to know already.

In an attempt to accommodate all types of BASIC language products, PC Labs has devised a series of performance tests that single out the speeders from the rest of the pack. These tests take a timed look at computation, screen updating, file handling, and a few other operations that are common to all systems tested. In all, *PC Magazine* reviews ten BASIC languages here that run under DOS; one system we considered, Theos BASIC, requires a proprietary operating system and therefore could not be included in a fair comparison.

Naturally, no timed test will tell the entire story; these are simply relative indicators. Pay careful attention also to the individual reviews, where each product's strengths and weaknesses are discussed—as is its target market, which should also factor in to your buying decision.

READY FOR TOMORROW

BASIC has evolved from a slow and limited language interpreter into a modern compiled powerhouse that is also very easy to use. But where is BASIC headed, and how will it get there? Perhaps even more important, how well suited is BASIC for the applications of tomorrow?

As the current leader in BASIC products, Microsoft has made clear its commitment to the future of BASIC by continuing to improve the language and, most recently, by making it easier to learn than ever before. With the introduction of QuickBASIC 4.5, Microsoft is attempting to woo thousands of frustrated *Lotus 1-2-3* and *dBASE* programmers with the many benefits of a real programming language. Long-range goals include Microsoft's adding a database engine and embedded macro language capabilities for several popular applications.

Programming in BASIC admittedly requires more effort than creating a macro in *1-2-3* or writing a *dBASE* program. But your first realization that you have complete control over every aspect of a program's operation and appearance is an exhilarating experience. The future of BASIC is perhaps more a question of how it will be used and by whom than merely a list of new features to be added.

Nonetheless, BASIC is continuing to grow, and a compiler for OS/2 programs is now available. (See the sidebar "Calling OS/2 Functions from BASIC.") Microsoft BASIC 6.0 includes examples, declarations, and TYPE definitions for calling OS/2 kernel routines, plus the ability to open pipes and perform interprocess communication. In addition, dynamic arrays under OS/2 can be nearly any size, limited only by available disk space.

Obviously, the BASIC language will continue to be enhanced and improved. In keeping with other evolving programming trends, future versions of QuickBASIC will have object-oriented extensions, as well as specific support for graphical user interfaces like IBM's OS/2 Presentation Manager. And for each new improvement Microsoft adds to its line of BASIC compilers, you can be sure that other products under review will counter with a few tricks of their own.

BB^X Progression/3

by Ross M. Greenberg

There's a lot to be said for being Microsoft BASIC compatible. But looking at Basis International's $200 BB^X Progression/3 tells me there is a lot to be said for *not* being Microsoft compatible. Business Basic, the precursor to BB^X, was a product before Bill Gates ever sold his first copy of BASIC—and Basis has been steadily enhancing the language ever since.

The syntax is BASIC-like, but the command structure is substantially different. Opening a file, for example, requires you to use a command of the form

```
open(channel,MODE=mode,ISI=type,
ERR=lineno)"FILENAME"
```

which is a bit of a cross between FORTRAN, C, and BASIC.

Since BB^X is really a business-oriented BASIC, it has some hooks that make it more applicable for the business community than other BASICs. Unlike most compatible BASICs, BB^X is set up with multiuser access in mind, with file and record locking as intrinsic pieces of the package. Its 14-digit precision, using Binary Coded Decimal (BCD) floating point, means that your end-of-month processing will add up to the exact penny, without rounding errors.

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Basis International's BB^X Progression/3 package contains a number of useful utility programs written in BB^X, including ones that can automatically write Lotus .WKS files. The screen at left shows an example of the BROWSE program looking at a copy of itself.

regardless of the platform on which it is running, produces the same tokenized p-code (pseudocode). Having the appropriate BB^X p-code interpreter sitting on the target system will allow the same source code to be used on any platform. There are few porting considerations to concern yourself with, and even these are adequately covered in the manual.

IMPRESSIVE SUPPORT

This device independence is reflected in BB^X's installation procedures, which I found to be quite easy. You are presented with a list of the displays, printers, and plotters you can have attached to the system and are asked what to name them. The current list of supported devices is pretty impressive, but check to make sure your particular needs are covered before you decide to purchase the package.

Some of BB^X's unique power is readily apparent in its file- and device-handling capabilities. A file may be one of the following types: String, Indexed (fixed length, random access), Keyed (fixed length, keyed access), MKeyed (fixed length, multiple keyed access), Program Files, Serial (varying record length with random access), and Directory files (where the operating system allows for direct access). The most impressive of these is the MKeyed file access, which allows for up to 16 keys per record, with the keys set in either ascending or descending order. Unless your programming needs are extremely heavy, you'll find that 16 keys per file will suffice.

The user interface is typical—full-screen and command-line-driven—with a pleasant editor interface: type EDIT 10 and a small window pops up in the middle of the screen. But the program would be better with fewer cryptic error messages and some on-line help.

Programmers who are used to creating a variety of utilities will be glad to see that the package contains a hefty list of useful programs, not the least of which is an unexpected one that can automatically write Lotus .WKS files!

BB^X is not a package for the timid, novice BASIC programmer. It's for the professional developer who wants to get a product out the door as quickly as possible, without letting the operating system get in the way. If that describes you, you should be prepared to learn a new language that feels very much like BASIC but isn't at all what you're used to.

FACT FILE



BB^X Progression/3
Basis International,
5901 Jefferson St. NE,
Albuquerque, NM
87109; (800) 423-1394
(505) 345-5232.
List Price: $200
Requires: 640K RAM, DOS 3.0 or later. Hard disk recommended
In Short: Its lack of Microsoft compatibility does not detract from this business-oriented p-code interpreter's merit. While not for the timid—thanks to cryptic error messages and lack of on-line help—BB^X provides multiuser access and easy porting to a multitude of systems, including most Unix variants.

CIRCLE 420 ON READER SERVICE CARD

GW-BASIC and BASICA

by Stuart R. Greenberg

My first exposure to Microsoft's BASIC interpreter required me to load the program I had written into my homemade "micro" (we didn't call them PCs then) from paper tape. A few years later, I had Microsoft BASIC available at the click of the power switch on a Radio Shack TRS-80. Now, on a 386-based PC with 8MB of memory, the granddaddy of personal computer languages is showing its age.

Microsoft's generic interpreter, GW-BASIC (included with most MS-DOS versions), and IBM's version, BASICA (included with PC-DOS), are essentially the same program. IBM optimized the interpreter by putting part of the program in the BIOS ROM and leaving only the disk-based portion available for future modifications and enhancements.

While our tests show that BASICA is faster in screen I/O, improvements made by Microsoft to GW-BASIC gave it a faster execution speed than BASICA in non-screen operations. BSAVE and BLOAD test results showed GW-BASIC to be four times as fast because of file-buffering enhancements not present in BASICA. Since the differences between the two are mainly in operating speed, both programs will hereafter be referred to as GW-BASIC.

NO COMPETITION

In many respects, GW-BASIC just can't match up to other BASIC languages. For instance, while GW-BASIC still requires line numbers to be present on each line of code, some of the newer BASICs have eliminated this need; anyone who's written

FACT FILE

GW-BASIC and BASICA
Microsoft Corp. and IBM Corp.
List Price: Sold bundled with DOS on most computer systems.
Requires: 256K RAM, matching DOS version.
In Short: While BASICA uses code from the IBM PC's own ROM BIOS and therefore needs a true IBM to run, GW-BASIC has no such limitations. Suitable only for small tasks, the two programs are functionally the same and suffer from limited memory space.

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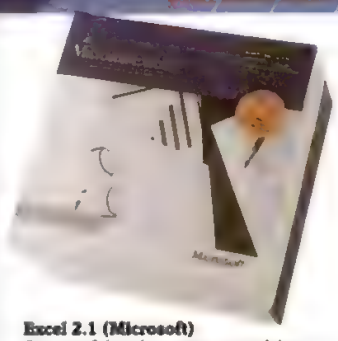
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Software is not copy protected, except where marked by asterisk.

CONTEST RULES **1.** Entries must be received on or before 1/31/90. **2.** Winner selected in random drawing by attorneys for Micro Warehouse Inc., (MWH), whose decisions are final. **3.** Prize subject to availability. MWH reserves the right to substitute wholesale cash value up to $5,000. **4.** Winner responsible for taxes. **5.** Odds of winning depend on number of entries. **6** MWH will announce the winner on or around 2/28/90. Winner will be notified by mail. Dates subject to change at the discretion of MWH. If unable to contact any winner, an alternate will be selected by random drawing. **7.** Contest is open to US residents, except where prohibited by law. Employees of MWH and suppliers not eligible. **8.** Prize - one Compaq SLT 286 w/640K RAM and 40Mb Hard Drive.

MODEMS & FAX BOARDS

GVC Chenel
Mini Modem 2400bd AC/DC ..... 157.
Practical Peripherals
Modem 2400SA Ext ..... 174.
PM2400 MNP/Lvl 5 (Int) ..... 174.
Quadram
JT Fax Board 9600bd Int ..... 545.
JT Fax Portable ..... 350.
The Complete PC
The Complete Fax 4800bd ..... 249.

MONITORS

NEC
Monitor Multisync 2A ..... 495.
Monitor Multisync 3D ..... 659.
Monitor Multisync GS ..... 219.
Princeton Graphics
Ultra-14 VGA ..... 539.
Zenith
ZCM 1490 14" Flat Screen ..... 599.

PRINTERS & CARTRIDGES

Citizen
120D and 180D ..... 138./159.
Pacific Data Products
25 Cartridges in One! ..... 283.
Pacific Page ..... New
Plotter in a Cartridge ..... 255.
Panasonic
KX-P1124 Dot Matrix ..... 329.

BASIC code with line numbers knows that this is a tedious task. Even if you use a separate utility program to input line numbers automatically, this still adds a significant amount of time to the development process.

Another problem with GW-BASIC is the limited memory space it offers for code and data. Regardless of the memory capacity of your PC, GW-BASIC programs must fit within about 60K of space. That means you may have to trim a program by either tightening some code or, in extreme cases, deleting comments. Today's complex applications demand that large quantities of memory be available, and comments can no longer be considered expendable.

Splitting programs into smaller units to accommodate restricted memory space is cumbersome because of the limitations of overlay processing. Normally, GW-BASIC stores programs in a tokenized form—each keyword is replaced by a 1- or 2-byte "token" to save space and processing time. Overlay programs, however, have to be stored in ASCII format with each keyword spelled out. This slows down the loading process considerably.

With serious application developers abandoning GW-BASIC for the more advanced BASIC compilers, why use GW-BASIC at all? The fact that it's included with most versions of PC- or MS-DOS makes it a handy tool for first-time BASIC programmers to experiment with. You can also use it for quickie tasks where a few lines of code will do the job. That's about as useful as it gets, though. Microsoft would be doing everyone a favor if it retired GW-BASIC and replaced it with a stripped-down version of QuickBASIC.

PopBASIC

by Ross M. Greenberg

Hedge Systems' PopBASIC, Version 3.0, a $79 TSR package, is the newest program to deserve a permanent home on my hard disk. Once it is added to your AUTOEXEC.BAT file, a BASIC interpreter is available via a single hotkey.

Pressing the hotkey pops up a window—really a powerful programming environment. The PopBASIC language varies somewhat from the Microsoft BASIC standard, but most of the differences are easy to grasp. Notably, PopBASIC does not have any data typing, allowing a variable's contents to be considered only in the context of a given operation performed on it. For example,

```
q = "2" + "2"
```

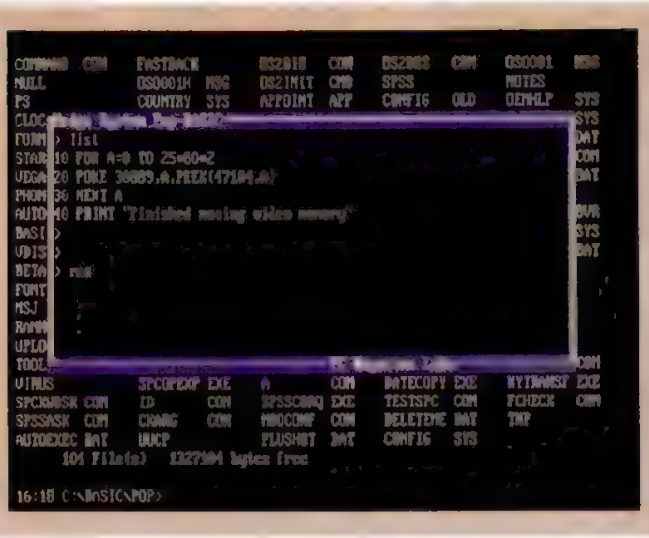
would generate a syntax error in most BASIC, but it is a valid statement in PopBASIC. Since PopBASIC notation uses a colon (:) rather than the standard plus sign (+) as the string concatenation operator, it may take a while before you're comfortable that the syntax

```
a$ = "2" + "2"
```

causes the variable a$ to contain the numeric value 4 instead of the more traditional 22.

PopBASIC includes memory-resident extensions that allow programs written in it to do some interesting operations, including reading the screen of and sending keystrokes to the interrupted foreground program and using a timer for preprogrammed operation.

A variety of other extensions add power to PopBASIC. These include sophisticated string handling, bit manipulation, and date- and time-handling functions. Additionally, many DOS functions, such as changing a file's attributes or creating and removing directories, can be done within PopBASIC programs.



Hedge Systems' PopBASIC includes overlapping windows and the use of common variables in compiled programs. Here, a program to move video memory sits atop a directory listing; normally full-sized, the pop-up screen has been modified for this review.

MEMORY USAGE

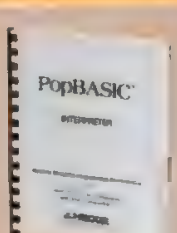
Since BASIC programs have a habit of expanding until they fill all available memory (plus 1 byte), PopBASIC's ability to use overlay files—pieces of a program that reside on-disk and can be loaded on top of the currently running program—can prove valuable.

PopBASIC's user interface is a pretty simple one: no pull-down menus or bells and whistles on this package. Alas, this means that on-line help is missing—a potential problem for a language that is not a superset of the more standard BASIC. The lack of on-line help, however, does keep PopBASIC from expanding beyond the 160K it already uses, and the clearly written manual provides good examples of each command.

PLUSES AND MINUSES

I was not particularly fond of PopBASIC's editing facilities. I'm more accustomed to doing my program editing in a text processor and simply loading the program into an

FACT FILE



PopBASIC, Version 3.0
Hedge Systems, 511 W. Glen Oaks Blvd., # 230, Glendale, CA 91202; (818) 243-2235.
List Price: $129.95 ($79 without optional compiler).
Requires: 192K RAM, DOS 2.0 or later.
In Short: This BASIC interpreter is available via a single hotkey to offer a simple user interface and a powerful programming environment. It isn't fully compatible with the Microsoft standard, but the differences are easy to grasp. A variety of memory-resident extensions, plus the ability to use overlay files, help balance PopBASIC's poor editing facilities and absence of on-line help.

CIRCLE 422 ON READER SERVICE CARD

BASIC LANGUAGES: SUMMARY OF FEATURES

(Products listed in ascending price order)

The following commentary analyzes some of the terms in this table of features. The phrases in bold type are listed in the same order as in the left-hand column of the table.

Product category An interpreter translates BASIC code into machine language during program execution. Compilers are divided into two categories, depending on whether they produce native code or p-code. Native code executes directly on the targeted machine; p-code, a generalized machine code, requires a runtime p-code interpreter.

Application distribution options There are several ways of circulating the programs created in the various dialects of BASIC. The .EXE or .COM format can be used for a standalone command file, which may consist either of native code or of a front-end p-code interpreter concatenated with the generated p-code. In cases where native code is accompanied by an external runtime module, the module's size is indicated; where p-code and an external interpreter are used, the size of the interpreter is given. In some cases, the user is not given a command file at all, but the source text file.

Help If a help facility is provided, it may be general or context-sensitive. It may also allow the programmer to modify the help text.

Error handling Some dialects of BASIC will find the first error in a program and then interrupt processing, while others will produce a listing of multiple errors. If the compiler or interpreter displays an erroneous line (or line number) and allows the programmer to edit the code, then error handling is said to be integrated with the package's editor. Many packages allow the programmer to continue compiling or running the program after correcting the error.

Debugging A debugger, in this context, is an error-trapping and monitoring tool that contains its own distinct command set. It may be available at additional cost or included with the language. If a debugger is available, it can be a standalone program that runs outside the programming environment, or it can be integrated with the compiler, the editor, or both.

Tracing is a visual debugging aid that allows the programmer to see the sequence in which lines

	GW-BASIC/BASICA	QuickBASIC 4.5	True BASIC	Turbo Basic 1.1	PopBASIC	Thoroughbred BASIC	BB+ Progression/3
List price	Included with DOS	$99.00	$99.95	$99.95	$129.95 (with compiler)	$195.00	$200.00
OPERATING ENVIRONMENT							
DOS	■	■	■	■	■	■	■
OS/2	❑	■	❑	❑	❑	❑	■
OS/2 Presentation Manager	❑	❑	❑	❑	❑	❑	❑
PRODUCT CATEGORY							
ASCII interpreter	■	❑	❑	❑	■	❑	❑
Native-code compiler	❑	■	❑	■	❑	❑	❑
P-code compiler	❑	■	■	❑	■	■	■
APPLICATION DISTRIBUTION OPTIONS							
Standalone native code (.EXE or .COM)	❑	■	■	■	■	❑	❑
External runtime module plus native code (module size)	❑	■ (77K)	❑	❑	❑	❑	❑
External interpreter plus p-code (interpreter size)	❑	❑	❑	❑	■ (54–160K)	❑	■ (180K)
Source code	■	❑	❑	❑	❑	■	❑
HELP							
General interactive help included	❑	■	■	■	❑	❑	■
Context-sensitive help	N/A*	■	❑	■	N/A*	N/A*	❑
User-modifiable help text	N/A*	❑	❑	❑	N/A*	N/A*	■
ERROR HANDLING							
Catches multiple errors	N/A†	■	❑	❑	■	N/A†	■
Can be integrated with editor	■	■	■	■	❑	■	■
User can fix error and continue	❑	■	■	❑	❑	■	■
DEBUGGING							
Standalone debugger	❑	In $299 package	❑	❑	❑	❑	❑
Integrated debugger	❑	■	❑	■	❑	■	■
Unselective tracing	■	❑	■	❑	■	■	❑
Selective tracing	■	■	❑	■	❑	■	■
Breakpoints	❑	■	■	❑	❑	■	■
DATA TYPES							
Watchpoints	❑	■	■	❑	❑	❑	❑
Strings:							
Fixed-length strings	❑	■	❑	❑	❑	❑	■
Maximum size	255 bytes	32K	32K	32K	64K	32K	Limited by memory

—Editor's Choice ■—Yes ❑—No

N/A*—Not applicable: the product does not have this feature.
N/A†—Not applicable: multiple-error detection and code optimization do not apply to interpreters, which interpret and execute one line of code at a time.

are executed. Some packages let the user select a range of lines to be traced, using interactive commands or code embedded in the program. Others do not allow a range to be selected and will trace the entire program.

Breakpoints are invisible flags that automatically suspend program execution; a watchpoint will suspend execution when a specified condition becomes true.

Strings These languages allow users to store variable-length and sometimes fixed-length character strings. In some cases, using fixed-length strings can reduce processing time.

387BASIC	Watcom BASIC	Microsoft BASIC 6.0
$250.00	$250.00	$295.00
■	■	■
❑	❑	■
❑	❑	❑
❑	■	❑
■	❑	■
❑	❑	❑
❑	❑	■
■ (68K)	❑	■ (77K)
❑	❑	❑
❑	■	❑
❑	■	■
N/A*	❑	■
N/A*	■	❑
■	N/A†	■
❑	■	■
❑	■	■
❑	❑	■
❑	❑	■
┘	┘	┘
■	■	■
┘	■	■
┘	┘	■
┘	┘	■
32K	32K	32K

CONTINUES

interpreter or compiler. Luckily, nothing in PopBASIC prevents you from doing this; in fact, this is even easier to accomplish with PopBASIC, since you need never leave your text editor. Simply pop up the PopBASIC program with your hotkey and then load in your text file.

Unlike Microsoft's BASICA, PopBASIC is not encumbered by wimpy limitations on string size. A string can be as long as 64K (limited by available memory), though constant strings are still limited to 256 bytes, a strange compromise.

One of the additional features of PopBASIC is its standalone compiler (available for $50 more), which allows you to create some rather sophisticated pop-up programs of your own.

This latest version of PopBASIC has some exciting enhancements over older releases, including multiple overlapping windows and the ability to use common variables in compiled programs. Certain features are still lacking, such as the ability to determine system time to the nearest fraction of a second, a problem we encountered during our testing. But being able to pop up a full BASIC interpreter with a single keystroke from within virtually any application was astounding enough to cause me to overlook any such limitations.

QuickBASIC 4.5 Microsoft BASIC 6.0

by Ethan Winer

When Microsoft developed the original BASCom 1 compiler (QuickBASIC's predecessor) for MS-DOS, it was clear that BASIC would never again be just for beginners. In the years that followed, no fewer than six new versions have been released, and each offering has boasted more capabilities than the one before it. The latest releases of both Microsoft BASIC 6.0 ($295) and its sibling, QuickBASIC 4.5, ($99) represent the state of the art not only for BASIC, but for any compiled language.

Programming with QuickBASIC 4.5 is a great pleasure, thanks to an integrated editor/compiler that lets you write programs and run them immediately. When syntax or other errors are detected, the cursor is placed on the offending statement, and an appropriate message is displayed. One particularly nice touch is the way QuickBASIC's editor automatically places each subprogram and function into its own editing window. The organization of components into these easily manageable logical portions greatly simplifies viewing and editing large programs. Two windows may be displayed at once; and text may be cut, pasted, and copied between them.

IMMEDIATE WINDOW

Unlike most language compilers, QuickBASIC provides a window where direct statements like PRINT X may be immediately entered and executed. Another difference from competing products is that there is only a minimal delay before a program begins to run. In contrast, using Borland's Turbo Basic 1.1 to recompile a large program in memory can take several minutes, even if only a single line has been changed.

QuickBASIC 4.5 can accomplish all this because the product is actually two compilers in one package. During program development, a sophisticated interpreter executes each instruction nearly as fast as it would if the program were compiled. Completed programs may then be compiled into true standalone .EXE programs either from within QuickBASIC's

PC MAGAZINE FACT FILE

EDITOR'S CHOICE

Microsoft Corp., 16011 NE 36th Way, P.O. Box 97017, Redmond, WA 98073-9717; (206) 882-8080.



QuickBASIC 4.5
List Price: $99
Requires: 384K RAM, DOS 2.1 or later.

CIRCLE 423 ON READER SERVICE CARD

Microsoft BASIC 6.0
(formerly BASCOM)
List Price: $295
Requires: 320K RAM, hard disk, DOS 2.1 or later or OS/2 1.0 or later.
In Short: QuickBASIC 4.5 defines the state of the art in programming-language environments. Beyond many new language features, QuickBASIC 4.5 provides the shortest route to a complete application. And if you plan to program for OS/2, Microsoft BASIC 6.0 is the only game in town.



CIRCLE 424 ON READER SERVICE CARD

BASIC LANGUAGES: SUMMARY OF FEATURES

(Products listed in ascending price order)

Integers—whole numbers—may be stored as 16- or 32-bit binary values.

Floating-point numbers contain a nonfixed decimal point. If a language does not directly support floating-point numbers, it converts strings or integers into a usable form during computations. Some packages support a mathematical coprocessor.

Arrays An array is a numbered set of strings or numeric values. Matrix functions are those that can be performed on an entire array at once. They may include addition, subtraction, multiplication, division, inversion, inner product, and outer product.

Redimensioning means redefining the size of an array at any time during program execution. This can be done either by using a direct command or by deallocating the array and using the DIM command.

Graphics A package with "turtle graphics" lets you give drawing commands by defining the direction, distance, and pen mode (pen up/down, color). Object drawing can include individual pixels, lines, rectangles, circles, ellipses, and polygons. The package may also allow you to fill such objects with color or patterns.

Record files The user can access files either sequentially— one record after another —or randomly by specifying a record numerically or searching on a value of one or more key fields.

DOS and BIOS support There are several ways a program can access DOS and BIOS functionality. One is by executing the command processor and passing the DOS commands as parameters. Another method allows direct access to system interrupts (INTs). If the DOS INT (INT 21h) is accessible, the programmer will have access to the low-level DOS routines. If all INT routines can be accessed, then BIOS and other routines are available as well.

Compiler optimization Some compilers automatically generate machine code that is

	GW-BASIC/BASICA	QuickBASIC 4.5	True BASIC	Turbo Basic 1.1	PopBASIC	Thoroughbred BASIC	BB* Progression/3
List price	Included with DOS	$99.00	$99.95	$99.95	$129.95 (with compiler)	$195.00	$200.00
Integers:							
16-bit	■	■	❑	■	■	■	■
32-bit	❑	■	❑	■	❑	■	■
Floating-point numbers:							
32-bit	■	■	❑	■	❑	❑	❑
64-bit	■	■	■	■	■	❑	❑
IEEE format supported	❑	■	■	■	■	❑	■
8087/80287/80387 coprocessor support	❑	■	■	■	❑	❑	❑
ARRAYS							
Matrix functions	❑	❑	■	❑	❑	❑	■
Direct redimensioning command	❑	■	■	❑	❑	■	■
Redimensioning using ERASE and DIM	■	■	❑	■	■	❑	❑
GRAPHICS							
Turtle graphics	■	■	❑	■	❑	❑	■
Pixels	■	■	■	■	❑	❑	■
Lines	■	■	■	■	❑	❑	■
Rectangles	■	■	■	■	❑	❑	■
Circles	■	■	■	■	❑	❑	■
Ellipses	■	■	■	■	❑	❑	■
Polygons	❑	❑	❑	❑	❑	❑	■
Filled objects	■	■	❑	■	❑	❑	■
RECORD FILES							
Sequential access	■	■	■	■	■	■	■
Random access via relative record numbers	■	■	■	■	■	■	■
Random access via key fields	❑	❑	❑	❑	❑	■	■
DOS AND BIOS SUPPORT							
Command invocation	■	■	❑	■	❑	■	■
DOS INT functions directly available	❑	■	❑	■	❑	❑	❑
All INT functions directly available	❑	❑	❑	■	❑	❑	❑
COMPILER OPTIMIZATION							
Optimizes for size	N/A†	■	❑	❑	❑	N/A†	❑
Optimizes for speed	N/A†	■	❑	❑	❑	N/A†	❑
Optimizations can be disabled	N/A†	■	❑	❑	❑	N/A†	❑

—Editor's Choice ■—Yes ❑—No

N/A† —Not applicable: multiple-error detection and code optimization do not apply to interpreters, which interpret and execute one line of code at a time.

optimized to produce a smaller program file or faster program execution. In some cases, this feature can be disabled by the programmer.

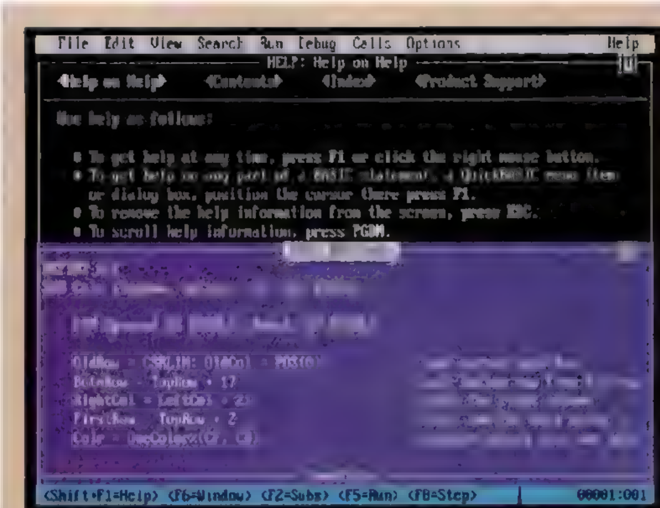
Additional notes:
■ None of the BASIC languages reviewed allows the use of expanded memory for data storage or code execution. PopBASIC, however, does use expanded memory for its runtime code.
■ Only Microsoft BASIC and QuickBASIC offer support for NetBIOS functions.
■ None of the reviewed packages supports a Weitek coprocessor.

387BASIC	Watcom BASIC	Microsoft BASIC 6.0
$250.00	$250.00	$295.00
■	■	■
□	□	■
■	■	■
■	■	■
■	■	■
■	■	■
□	■	□
■	□	■
■	□	■
■	□	■
■	■	■
■	■	■
■	■	■
■	■	■
■	■	■
□	■	□
■	■	■
■	■	■
■	■	■
□	■	□
■	■	■
□	□	■
□	□	□
□	N/A'	■
■	N/A'	■
□	N/A'	■

ENDS

editor or at the DOS command line.

Where QuickBASIC really shines is in the excellent debugging capability built into its editing environment. Perhaps its most important debugging feature is its ability to trace a program's flow from statement to statement while monitoring variable values. A unique history mode even lets you reverse the execution, to see how a program arrived at a given statement. You could tell QuickBASIC, for example, to halt the program if the variable X ever reaches a value greater than 10. By then stepping backward through the program, you can see where the variable was assigned and how the program arrived at the current statement.



Perhaps QuickBASIC's most appealing feature is its impressive on-line help. Hypertext technology is used to good advantage by QuickBASIC, which allows full access to all portions of the help system. Fully context-sensitive assistance is always available.

Besides being the easiest of the available BASIC compilers to learn and use, QuickBASIC 4.5 provides a wealth of other important features. These include huge arrays with up to 32,767 elements, true functions, and sophisticated graphics commands that work in any of the CGA/EGA/VGA video modes. Hercules graphics is supported, though users will first have to run a special TSR support program from the DOS prompt. Also, QuickBASIC 4.5 lists for a mere $99; the only thing better is its big (and more expensive) sibling, Microsoft BASIC 6.0.

MICROSOFT BASIC 6.0

Microsoft's BASIC 6.0 includes the editing environment and standalone command-line compiler found in QuickBASIC, but the compiler in this incarnation has a number of useful enhancements. For starters, the documentation comes in separate three-ring binders, as opposed to the paperback manuals supplied with QuickBASIC. But the real difference is that BASIC 6.0 is able to create programs that run under DOS *or* OS/2. (See the sidebar "Calling OS/2 Functions from BASIC.")

Microsoft BASIC goes a step further by including a series of special object modules that eliminate unnecessary components of the BASIC runtime library. (Microsoft refers to these as "NO" object files because they have names like NOCOM, NOHERC, and NOLPT.) Normally, a program compiled with QuickBASIC or the BASIC compiler will automatically add the library routines for COM support, graphics, printer output, and so on, even if they are not needed. By explicitly linking one or more of these object modules with the BASIC program, the unneeded routines can be excluded from the final version at a considerable savings in executable file size. In some cases, the resultant .EXE program may be reduced by 10K or more.

Another important addition to the BASIC 6.0 compiler is an alternative math library, which works much faster than the standard IEEE numeric format used by all other Microsoft languages. Prior to QuickBASIC 4.0, all versions of Microsoft BASIC utilized a proprietary method for storing floating-point numbers; this entailed a tradeoff: math operations could be performed very quickly but at the expense of accuracy and compatibility with other languages.

When QuickBASIC 4.0 was introduced, with support for interlanguage calling and numeric coprocessors, Microsoft was obligated to abandon its nonstandard

PEEKING INSIDE THE BASIC COMPILER

by Ethan Winer

To the uninitiated, a BASIC compiler's translation of a source file into machine code that the PC's processor can execute may seem to be magic. In many cases, however, the conversion of a BASIC statement into assembly language is more straightforward than you might think.

In the interest of simplicity, this discussion will be limited to simple math operations that can be effectively translated into similar or equivalent machine instructions. (More-complex BASIC commands are converted into calls to the language library, which is another topic altogether.) In the examples that follow, Microsoft's QuickBASIC Version 4 was used because of its ability to generate an assembly language source listing while a program is being compiled.

STEP BY STEP

Let's say you have the BASIC statement X = 12 in a program. From that statement, QuickBASIC will generate the assembler instruction MOV WORD PTR X, 12. This tells the PC's processor to move the value 12 into the word-sized memory location that has been named X. As with BASIC, an assembly language program may refer to a variable by name; the assembler itself will do the dirty work of finding an appropriate memory address to hold it.

Next, consider the statement X = X + 100. QuickBASIC will translate this into ADD WORD PTR X, 100; that means add 100 to the variable X. Again, this is an instruction that the PC's processor can execute directly. In most cases, QuickBASIC will not be as smart as a human at coding in assembly language, but as the program on the right illustrates, it is extremely efficient when it comes to integral math operations.

In the example, X is first assigned the value 4 with the MOV instruction. Then the AX register (one of the processor's built-in variables) is loaded from X, where it stays throughout the remaining assignments. Understand that any operation performed on a register will be much faster than a similar operation performed on a variable kept in memory.

To multiply X by X, QuickBASIC generates an Integer Multiply instruction, and then places the result back into X. Because QuickBASIC is smart enough to realize that AX still holds the contents of X from the previous calculation, all the remaining operations are performed using AX.

To multiply X by 2, a Shift-Left instruction is used. This is more efficient than the Integer Multiply instruction—whenever the bits in an integer variable are shifted left one position, the value is effectively multiplied by 2. After shifting, X is again assigned from AX.

Multiplying X by 3 cannot be done with shifting, so the CX register (another of the processor's built-in variables) is first loaded with the value 3. CX is then used as the multiplier of AX. The answer, which is now held in AX, is moved back into X.

Two left shifts in a row are then used to multiply AX by four; again, the answer in AX is assigned to the variable X. Finally, the X + X assignment is elegantly handled by simply adding the AX register to the value of X.

These few examples barely scratch the surface of what a sophisticated compiler like QuickBASIC can do. But these program fragments do show that there is really nothing mysterious about a compiler. Armed with this knowledge, you might want to experiment with examples of your own—perhaps to see how QuickBASIC encodes a FOR/NEXT loop, or how a CALL statement is set up and processed.

ROLE OF THE OPTIMIZER

Besides merely translating your BASIC instructions, many compilers also perform what is called optimization. The Microsoft BASIC compilers, for example, will remember the results of a previous calculation and reuse them later. This feature makes it unnecessary for the compiler to generate the same code repeatedly.

This is transparent to the BASIC programmer and has the effect of either reducing the amount of code that is generated or increasing the speed of the resulting program. In the code fragment below, the expression X + Y * Array(10) would be evaluated, then stored in a temporary memory location:

```
IF X + Y * Array(10) > 100 THEN
        A = X + Y * Array(10)
ELSE
        B = X + Y * Array(10)
END IF
```

Thus, QuickBASIC will create code to calculate the expression just once and then use the results of that calculation. This would be equivalent to

```
Temp = X + Y * Array(10)
IF Temp > 100 THEN
        A = Temp
ELSE
        B = Temp
END IF
```

Because many steps are required to evaluate an expression, doing this once ahead of time can provide a considerable savings.



THE COMPILER TACKLES INTEGER MATH

```
X = 4
    MOV WORD PTR X, 4
X = X * X
    MOV AX, X
    IMUL X
    MOV X, AX
X = X * 2
    SHL AX, 1
    MOV X, AX
X = X * 3
    MOV CX, 3
    IMUL CX
    MOV X, AX
X = X * 4
    SHL AX, 1
    SHL AX, 1
    MOV X, AX
X = X + X
    ADD X, AX
```

While QuickBASIC ordinarily cannot match the human at coding in assembly language, the program above shows how efficient a compiler can be when it comes to integral math operations. Note that any operation performed on a register will be much faster than a similar operation performed on a variable kept in memory.

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format. This format has now been reinstated as an option in BASIC 6.0 for programs in which math performance is paramount and access to routines written in other languages is not needed.

PROBLEMS AND LIMITATIONS

As good as QuickBASIC 4.5 and BASIC 6.0 are, they are not perfect. One sorely lacking feature that should be added to both compilers is support for expanded memory. The unavailability of this support in any of the Microsoft languages is especially annoying when you consider that even a company as tardy as Lotus Development Corp. has been using EMS for years.

There is probably no cure for my other objections, since they are too deeply rooted in the Microsoft BASIC language syntax. For instance, many commands are confusing and inconsistent: to determine the current cursor line in a program you would use the CSRLIN function, but to obtain the current column you have to use POS(0). Even forgetting that a name such as CSRCOL would be more consistent, why in the world should this function even require a "dummy" argument? Equally confusing are the many graphics commands and all of their variations; the haphazard development of the syntax for graphics statements means that there are often several ways to achieve the same results.

These criticisms are not much more than minor quibbles, though. Microsoft clearly makes the BASIC to beat. And BASIC 7.0, expected by the end of the year, is intended to offer even more.

Thoroughbred BASIC

by Jay Munro

The word thoroughbred implies a distinguished bloodline, akin to royalty. As with royalty, however, Concept Omega Corp.'s Thoroughbred BASIC still embraces the rigid customs of the language's yesteryear.

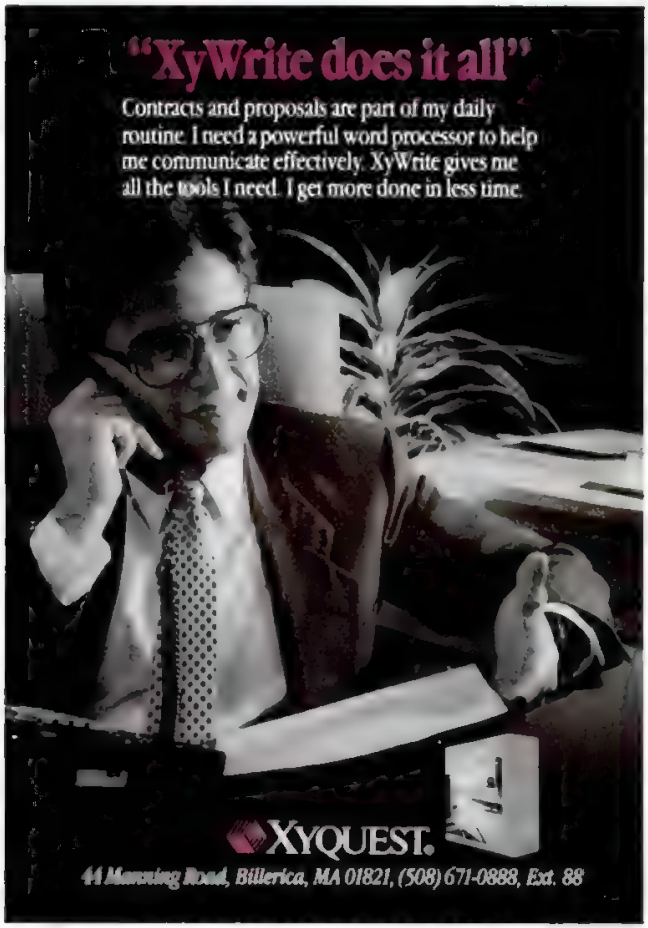
The $195 program's dialect is of the business BASIC genre, with syntax and keywords more common to the traditional world of mainframes than to the culture of today's PCs. As a result, aficionados of more-modern PC BASICs will find current business BASICs incompatible with, say, Microsoft QuickBASIC, and may prefer Thoroughbred for use only in a mainframe environment for applications requiring precision math and extensive file handling.

THOROUGHBRED AT THE GATE

To install Thoroughbred, you load the supplied floppy disk, change directories on the floppy to TBSC and type INSTALL. Installation to the hard disk is done for you, prompting for disks as needed and creating the TBSC directory if you haven't already done so. You can install the package in any directory, as long as the directory is called TBSC!

Once in the interpreter, instructions may be typed in either as immediate statements or with line numbers. One hassle: If you don't enable the CapsLock key, you'll get syntax errors from the start. Thoroughbred recognizes only capitalized keywords and variable names.

Editing is done either within the interpreter—line by line—or with the supplied Edit utility. Although the utility shows a



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PERFORMANCE TESTS: BASIC LANGUAGES (RUNNING UNDER AN EDITOR OR INTERPRETER)

Largely because of its error handler, even the Editor's Choice, QuickBASIC 4.5, falls short on certain tests. But while error-trapping routines will also slow down compiled programs during their development, fortunately the error handling occurs only once. Not so for interpreters, which must parse each line of code whenever the program is run.

All BASIC language tests were run on an IBM PC AT equipped with an Intel Above Board supplying backfill to 640K, 1MB of extended memory, and 1MB of expanded memory. We also fitted each machine with an 80287 math coprocessor, a VGA adapter board, and a freshly formatted 32MB hard disk.

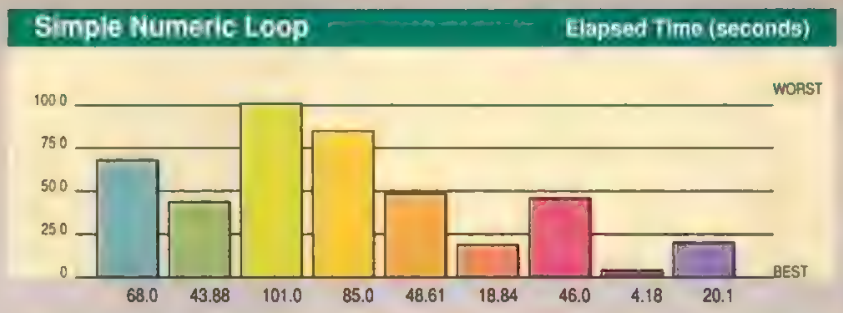
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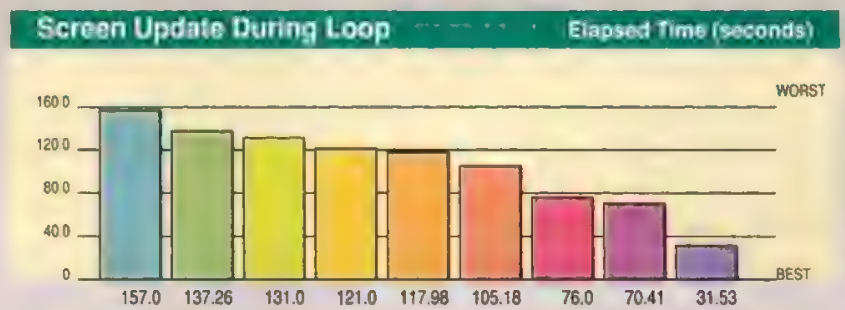
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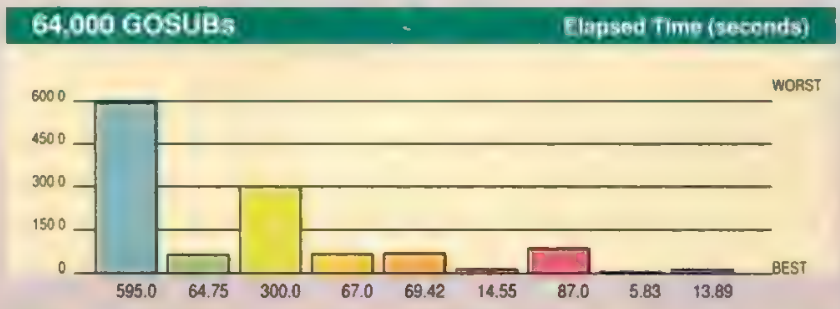
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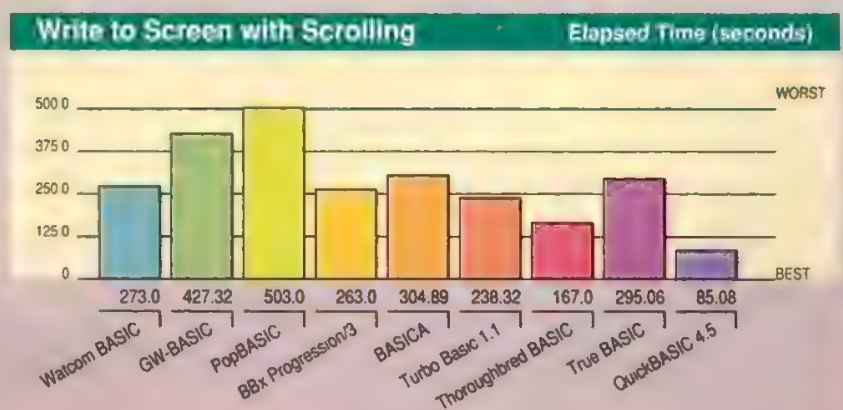
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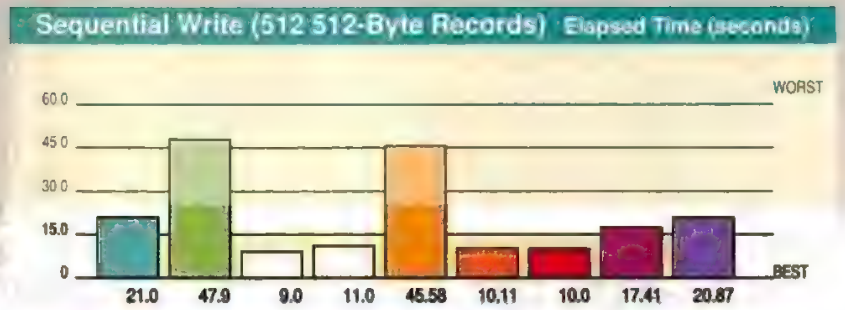


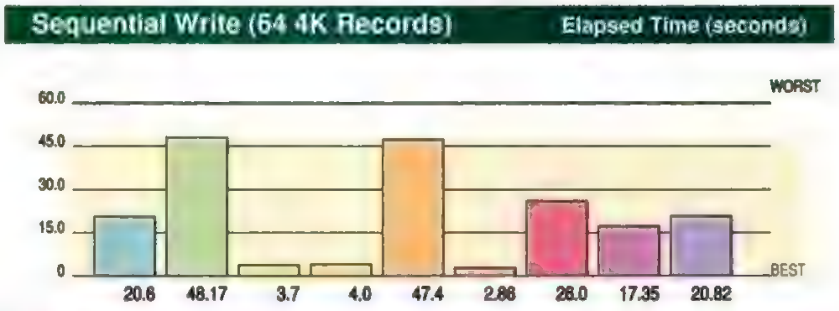


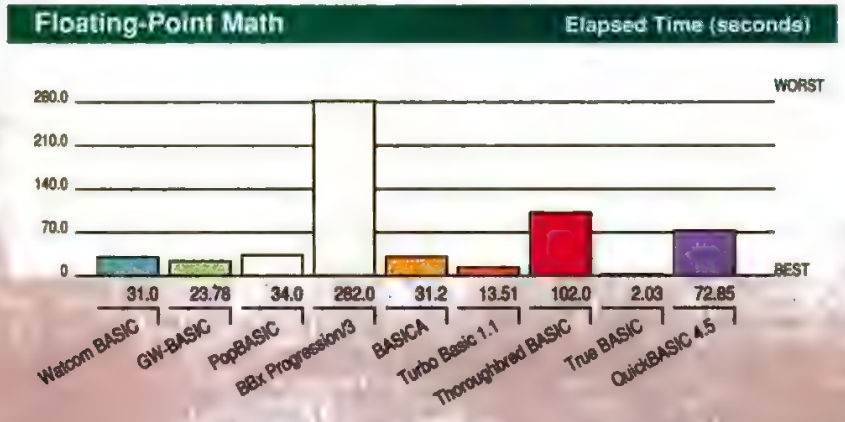
PERFORMANCE TESTS: BASIC LANGUAGES (RUNNING UNDER AN EDITOR OR INTERPRETER)

The **Sequential Write (512 512-Byte Records)** and the **Sequential Write (64 4K Records)** tests measure the time it takes to write a file of 512 512-byte records and a file of 64 4,096-byte records, respectively, to a freshly formatted hard disk. Both operations result in the same number of bytes (262,144) written to the disk, and times within the same BASIC dialect should be comparable, despite the differences in record size. While faster times do typically indicate better performance among the different dialects, extremely low numbers may simply result from a dialect's writing only a bufferful of information to disk rather than the entire series of records. Such writes are often completed when the file is closed or when the program is ending.

The **Floating-Point Math** test measures the time elapsed for a series of long-integer floating-point operations as a minimal test of the floating-point functions available within each dialect. Extremely short times typically indicate that the BASIC dialect is using the 80287 coprocessor chip installed in the test-bed. All dialects were installed in default mode with no additional extensions or modules added.







CONTINUES

screenful of code, it isn't a full-screen editor in the QuickBASIC style; a line to be edited is individually selected and then edited. While this may seem very slow, this method is still much easier than editing by command.

You may save program files written using Thoroughbred, but only in tokenized format. ASCII files can be imported via a short program obtained (for this review only) from Thoroughbred technical support or through the Merge command after special formatting. To save a program, you must specify the program name (with up to eight characters and no extension), the size of the program (a system variable PSZ), disk number, and sector.

ARITHMETIC FUNCTIONS

Thoroughbred BASIC boasts a full complement of arithmetic, conversion, and programmable numeric functions. There are also code conversion, logical/binary, and programmable string functions.

Numeric variables come in three flavors—32-bit integer, fixed, and BCD floating point; the last offers accuracy to 14 places—with none of the occasional rounding errors met when using GW-BASIC or QuickBASIC. Numeric arrays are allowed with up to three dimensions, but there are no string arrays.

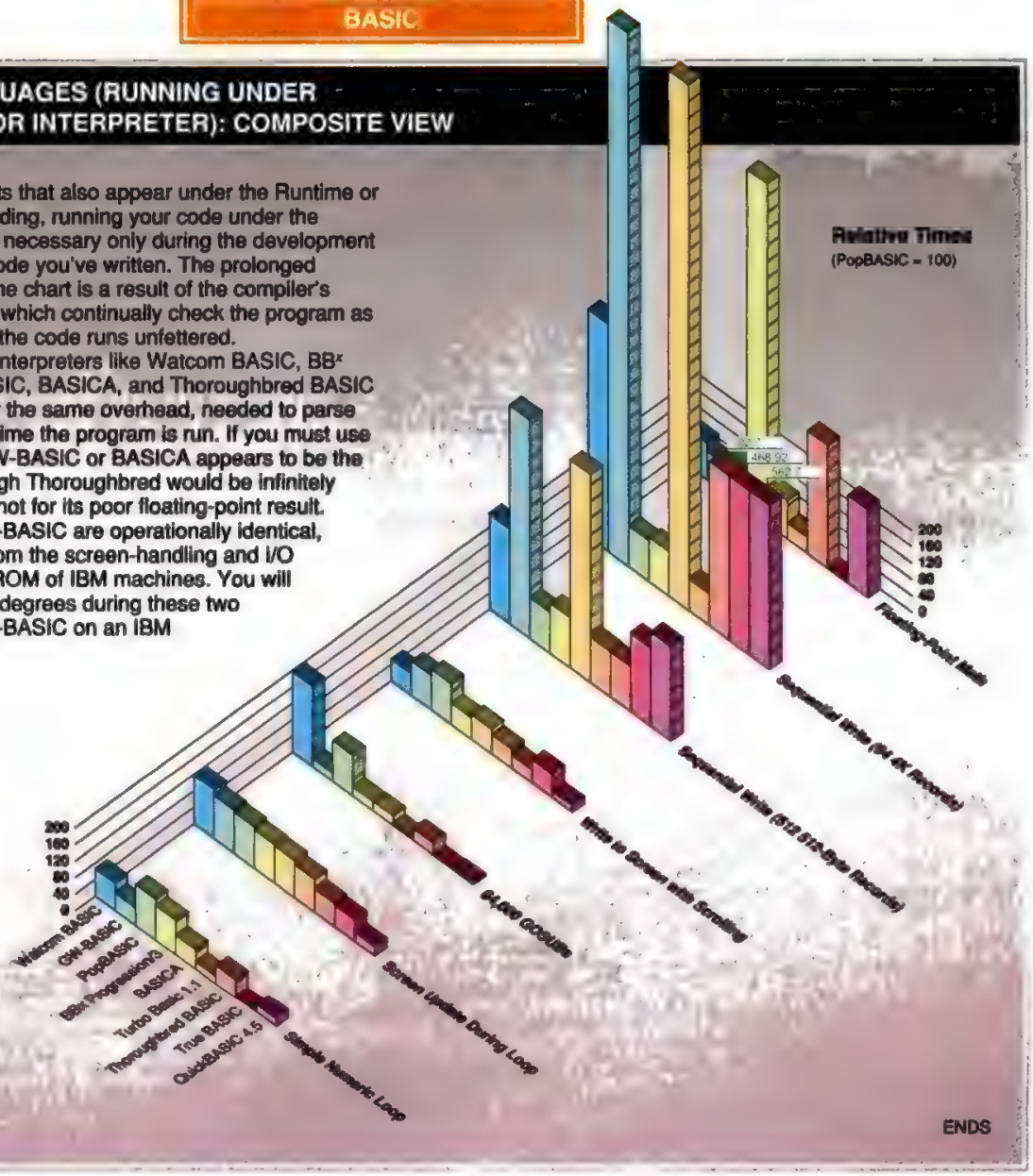
A greater limitation is that both numeric and string variables are limited to a single alphabetic character, optionally followed by a single numeral from 0 to 9. So much for readability!

Thoroughbred does show its stuff when it comes to file handling, the area for which business BASICs are best known. Supported file modes are Indexed, Direct, Serial, Sort, and Program files. Key sorting on Direct files is single-level only, but multikey sorts can be performed by using Sort files. All file services have error han-

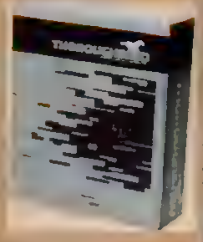
BASIC LANGUAGES (RUNNING UNDER AN EDITOR OR INTERPRETER): COMPOSITE VIEW

For those BASIC dialects that also appear under the Runtime or Standalone Module heading, running your code under the editor/interpreter will be necessary only during the development phase as you test the code you've written. The prolonged running time shown in the chart is a result of the compiler's error-handling routines, which continually check the program as it runs. Once compiled, the code runs unfettered.

Unfortunately, strict interpreters like Watcom BASIC, BB^x Progression/3, GW-BASIC, BASICA, and Thoroughbred BASIC are always burdened by the same overhead, needed to parse each line of code each time the program is run. If you must use an interpreter, either GW-BASIC or BASICA appears to be the dialect of choice, although Thoroughbred would be infinitely more appealing were it not for its poor floating-point result. While BASICA and GW-BASIC are operationally identical, BASICA does benefit from the screen-handling and I/O routines already in the ROM of IBM machines. You will be penalized to varying degrees during these two functions if you run GW-BASIC on an IBM computer.



FACT FILE



Thoroughbred BASIC, Version 7.4
Concept Omega Corp., 19 Schoolhouse Rd., P.O. Box 6712, Somerset, NJ 08875-9958; (201) 560-1377.
List Price: $195
Requires: 512K RAM, hard disk, DOS 3.0 or later.
In Short: A business BASIC interpreter of interest to VAR developers needing accurate-to-the-penny math and extensive file handling. Programs are directly transportable among DOS, Unix, and a proprietary operating system, but the lack of graphics, full-screen editor, string arrays, and descriptive variable names limits the package's usefulness.

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dling via a GOTO line if an error occurs; however, first-time users will be diving for the manual to decipher the tricky error numbers. (Occasionally two or three different problems are reported by one error number.)

For technical support, note that Concept Omega sells Thoroughbred BASIC direct and provides support primarily to VAR developers.

The DOS version of Thoroughbred BASIC has many interesting and useful functions that are not available in other BASIC versions. But the lack of a real full-screen editor, minimal and often cryptic documentation, the absence of on-line help, and restrictive syntax conventions will probably turn off many of today's BASIC programmers.

387BASIC

by Ross M. Greenberg

The name of Microway's 387BASIC tells the whole story: special support for a math coprocessor is an intrinsic part of this package. If you do plenty of floating-point and other complicated mathematical calculations, you'll appreciate the extraordinary speed with which 387BASIC handles these processes.

The $250 product is nearly compatible with more-common BASICs such as Microsoft's QuickBASIC or Borland's Turbo Basic. 387BASIC was designed to follow the standards of the IBM BASIC Compiler (Version 2.0), so porting programs written in that dialect or in its derivatives is easy.

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But if you're used to a more powerful environment, such as QuickBASIC 4.0, you've got a hefty job ahead of you.

In the manual there are adequate examples of how to port some of the trickier constructs and functions into 387BASIC functions, and since this is a compiler, there should be no impact on the speed of your application after it's ported.

Compatibility considerations aside, if you have a need for constructs like arrays with 18 dimensions, this is a hard package to beat. 387BASIC gives a lot of support to the professional programmer, with fairly easy access to assembly language interfaces, specific support for the different math coprocessors (8087, 80287, 80387), and "metacommands" that do such esoteric jobs as controlling event trapping and allowing arrays to be redimensioned dynamically in the compiled code.

The language also offers utility programs and programming concepts that enable you to easily convert back and forth between files whose floating-point numbers are stored in IEEE format and those whose numbers are stored in a different format.



387BASIC
Microway, P.O. Box 79, Kingston, MA 02364; (508) 746-7341.
List Price: $250
Requires: 320K RAM (512K recommended); 8087, 80287, or 80387 math coprocessor; DOS 2.1 or later. Hard disk recommended.
In Short: If you do plenty of floating-point and other complicated mathematical calculations, you'll appreciate the extraordinary speed with which 387BASIC handles these processes. And, with a few exceptions, this compiler is nearly compatible with more-common BASIC products, but there's no way to run the software without a math coprocessor.

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COPROCESSOR SUPPORT

387BASIC's use of the math coprocessor is transparent: when you use a math function that can be more readily performed using the math coprocessor, the appropriate code is generated. This is valuable when you use graphics functions, for example, to draw a circle or when you perform trigonometric functions.

That 387BASIC *requires* a math coprocessor, however, is a very serious problem if you're used to a BASIC that doesn't require one. Many users will be unwilling to buy a machine that has a math coprocessor just to run your software. Fortunately, 387BASIC's manual includes a section on how to write programs that will run on machines with or without a math coprocessor.

PERFORMANCE TESTS: BASIC LANGUAGES (RUNTIME MODULE)

Features, more than raw test results, distinguish *PC Magazine*'s two Editor's Choice products from the pack, but both Microsoft compilers command a strong lead in this set of performance tests—the slow screen-handling times of the other products under review negate their apparent superiority in the other tests. Note that fast sequential disk writes may indicate data writes to disk buffers rather than to the actual hard disk.

All BASIC language tests were run on an IBM PC AT equipped with an Intel Above Board supplying backfill to 640K, 1MB of extended memory, and 1MB of expanded memory. We also fitted each machine with an 80287 math coprocessor, a VGA adapter board, and a freshly formatted 32MB hard disk.

The tests themselves were designed to be as simple as possible and in most cases were written to have as few lines as possible. No attempt was made to test features that are excluded from some dialects of BASIC.

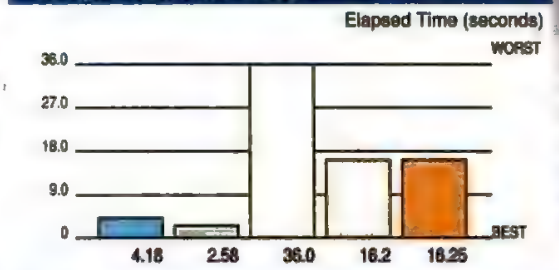
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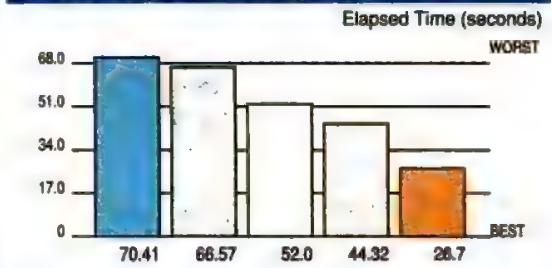
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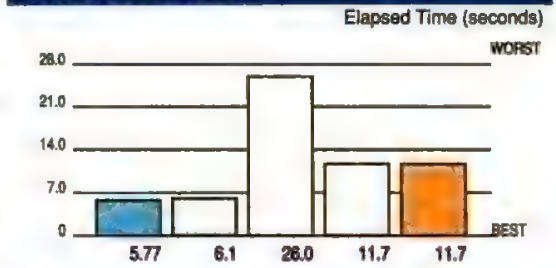
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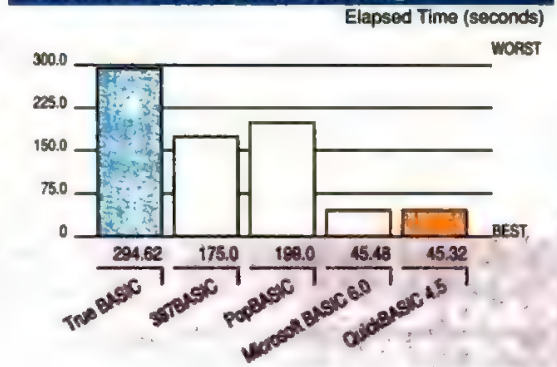
Screen Update During Loop



64,000 GOSUBs



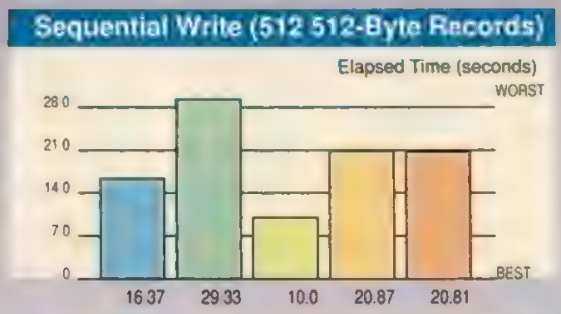
Write to Screen with Scrolling

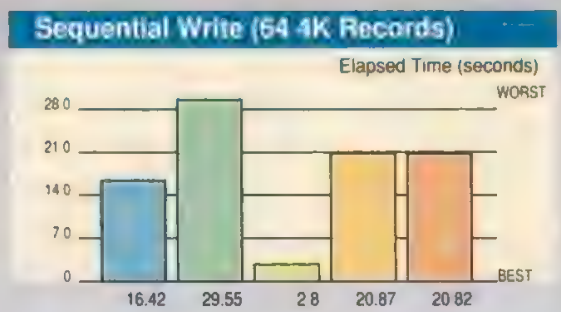


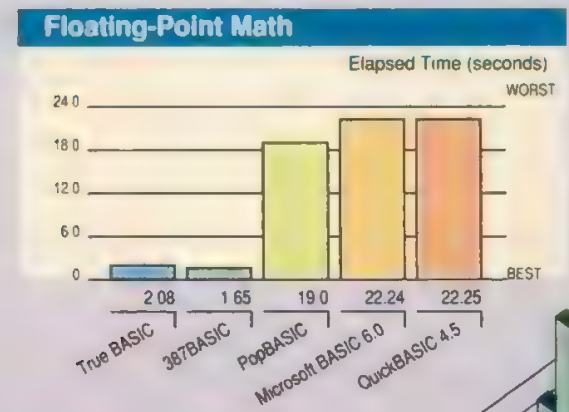
PERFORMANCE TESTS: BASIC LANGUAGES (RUNTIME MODULE)

The **Sequential Write (512 512-Byte Records)** and the **Sequential Write (64 4K Records)** tests measure the time it takes to write a file of 512 512-byte records and a file of 64 4,096-byte records, respectively, to a freshly formatted hard disk. Both operations result in the same number of bytes (262,144) written to the disk, and times within the same BASIC dialect should be comparable, despite the differences in record size. While faster times do typically indicate better performance among the different dialects, extremely low numbers may simply result from a dialect's writing only a bufferful of information to disk rather than the entire series of records. Such writes are often completed when the file is closed or when the program is ending.

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BASIC LANGUAGES (RUNTIME MODULE) COMPOSITE VIEW

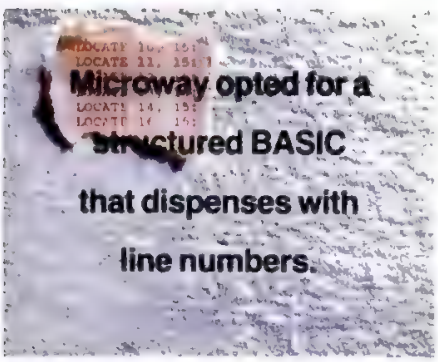
The first of two options in compiling to .EXE files, distributing your finished program with a runtime module or library, means that your code must refer to an external library of routines contained in the module as it runs. This can significantly reduce the size of the code you're producing and let you distribute several smaller programs with only one runtime library needed, but it sometimes entails paying royalties to the BASIC language vendor for use of the module.

From a pure speed standpoint, either QuickBASIC 4.5 or Microsoft BASIC 6.0 would appear to be a natural favorite when the full range of tests is taken into account. Turbo Basic 1.1 does not appear in the list because it compiles standalone .EXE programs.

lem. It means you won't be able to develop or run any 387BASIC program—even one that does not make use of the coprocessor's functionality—without this comparatively expensive component installed on your machine and on the machines of the end user. It would seem to be a trivial matter to build the compiler with a switch that would allow the runtime system to determine whether a math coprocessor exists and then execute the applicable code according to the coprocessor's existence and type. (There are slight differences in the 8087, 80287, and 80387 that require different coding practices.)

THE BASIC STRUCTURE

Microway opted for a structured BASIC, using labels and independent subroutines instead of line numbers. This allows for more modularity of code and therefore better control over the scope of your variables. Usage of the stack on the math co-



processor permits faster calculations and variable storage—consider these to be similar to register variables in C, though not as fast. Proper usage of these stack variables requires some careful considerations, and the manual does a good job of educating the programmer in this area.

In other respects, however, the manual needs some work; it consists of single-sided photostats stuck into a generic three-ring binder combined with an inadequate index and table of contents. While the manual may serve as a valuable enough reference tool, it is not suitable if you're *learning* 387BASIC.

387BASIC is exactly what it claims to be—an excellent implementation of math coprocessor support in BASIC. If you're finding that your calculations of pi or other mathematically intensive applications are taking far too long, take a look at this program.

PERFORMANCE TESTS: BASIC LANGUAGES (STANDALONE MODULE)

Tests run on standalone modules—the most common form of program distribution, despite the code-size limit imposed—reveal the most variety in testing a BASIC dialect's ability to perform elementary functions. Here, Turbo Basic 1.1 frequently surges ahead of Microsoft BASIC 6.0, although the latter's compiler-only design gives it the edge in three tests.

All BASIC language tests were run on an IBM PC AT equipped with an Intel Above Board supplying backfill to 640K, 1MB of extended memory, and 1MB of expanded memory. We also fitted each machine with an 80287 math coprocessor, a VGA adapter board, and a freshly formatted 32MB hard disk.

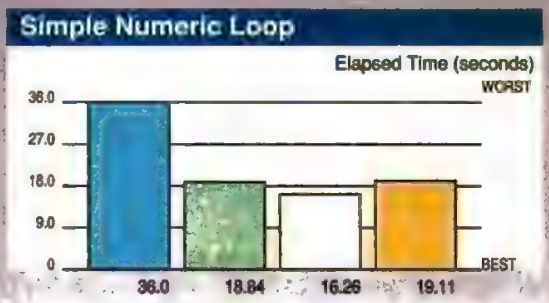
The tests themselves were designed to be as simple as possible and in most cases were written to have as few lines as possible. No attempt was made to test features that are excluded from some dialects of BASIC.

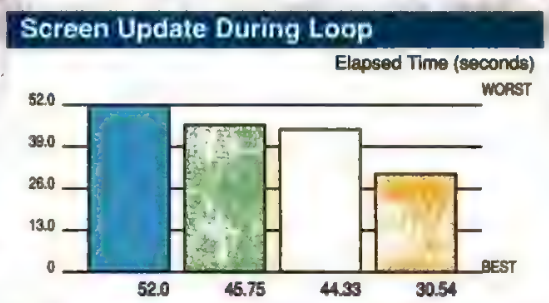
The **Simple Numeric Loop** test measures the time required to accomplish 10,000 iterations of these four math operations: *a=a+1*, *b=a*, *a*, *c=b-a*, and *d=b/17*, within a WHILE/WEND looping structure using the counter *n%=n%+1* until *n%>10,000*. During the repetitions of the first test phase, the counter variable *n%* is printed to the screen as it increments. This test provides an insight into the overhead required by the various dialects of BASIC to process simple math, variable assignments, and loops.

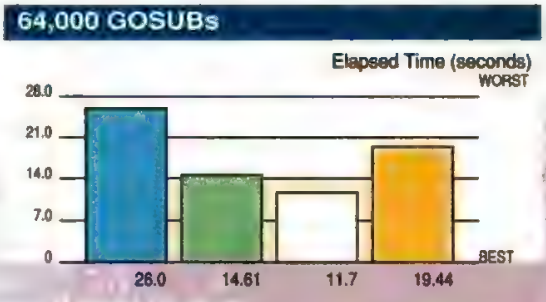
The second test involving a loop, the **Screen Update During Loop**, duplicates the preceding almost exactly; the only difference is that screen commands have been added to locate a particular coordinate on the screen and print the ascending value of *n%* as the test proceeds. If the difference between this result and that of the preceding test is high for the BASIC dialect that you're considering and you need to do screen updating, you should consider doing it on a periodic basis rather than after consecutive passes.

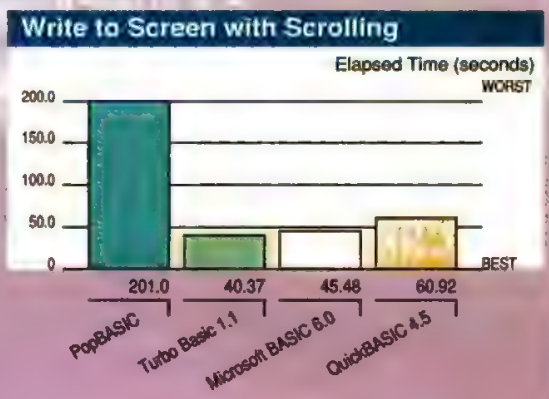
The **64,000 GOSUBs** test measures the time it takes to process a GOSUB *proc1* statement occurring 800 times within a WHILE/WEND loop that executes 80 times. The *proc1* subroutine contains the assignment *t=n* followed by a RETURN statement. In many cases, the majority of the time spent on this section will be for the assignment operation (*t=n*) rather than for the GOSUB itself. Therefore, although modularizing your code using GOSUBs rather than coding in-line clarifies the organization of the code, it yields little difference in execution speed. Consequently, dialects that produce fast results are preferable because of the speed of their operator assignments.

The **Write to Screen with Scrolling** test uses a FOR/NEXT statement to print the letter *H* 80 times across each of the 25 screen lines. This code segment is enclosed in a loop that iterates 40 times, and each new iteration begins the next series of print statements where the last one stopped; the top line consequently scrolls off the screen as each new line begins at row 25. The test times demonstrate the speed of the various BASIC dialects as they interact with the video BIOS in the course of normal programming activities.





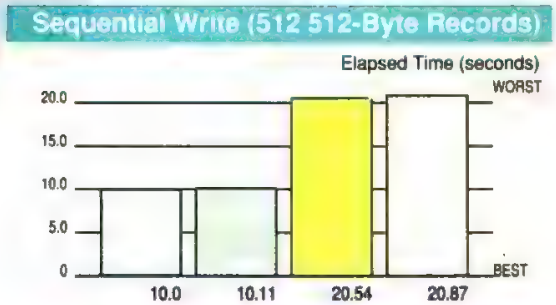


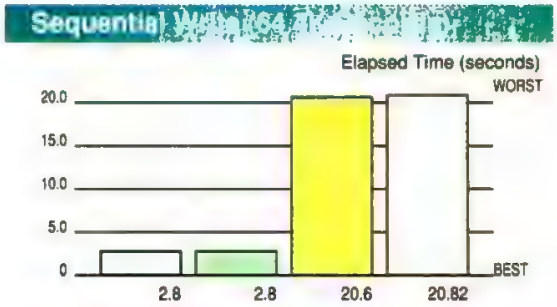


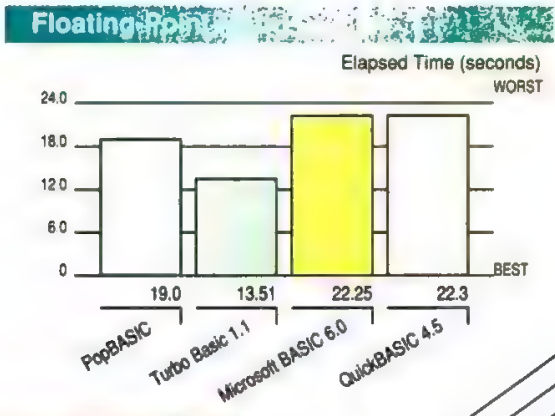
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BASIC LANGUAGES (STANDALONE MODULE): COMPOSITE VIEW

Standalone programs reflect the form most often encountered: .EXE files that have all library routines already encoded into the software and therefore have no need of a runtime module. The penalty here is in code size, which may be three or four times larger than a runtime-module-dependent version; the advantage lies simply in avoiding royalty payments to a runtime module vendor.

Although the dialect's screen handling is somewhat disjointed the intention of the original design of Microsoft BASIC as a compiler for BASIC code (and not as a separate dialect of the language) often gives it the advantage here in raw speed, even without the optional floating-point module added. After all, the code generated by Microsoft BASIC is identical to that generated by QuickBASIC, Turbo Basic 1.1, and BASICA/GW-BASIC, but Microsoft BASIC offers sophisticated optimization as well. If you require or prefer an interactive editor as the front end for your programming chores, QuickBASIC 4.5 is the package of choice.

True BASIC

by Dean Hannotte

True BASIC is not a fully Microsoft-compatible dialect of BASIC. But then again, GW-BASIC doesn't offer the many enhancements to be found in True BASIC either. The $99.95 True BASIC has evolved at a far more leisurely pace, and this shows in the more elegant look and feel of its command set. Furthermore, it alone can claim direct descent from the very first BASIC, developed 25 years ago by Dartmouth professors John G. Kemeny and Thomas E. Kurtz.

Actually, True BASIC is an implementation of the formal definition of BASIC developed by the American National Standards Institute in the mid-1980s, in which process Messrs. Kemeny and Kurtz played a substantial role; a few added features also go beyond the ANSI spec. Some of the features will intrigue those raised on the ubiquitous Microsoft interpreter.

Whereas in GW-BASIC, arrays must start with element 0 or 1, arrays in True BASIC can be "biased": a statement like "DIM YEARS(1900 TO 1999)" defines an array with 100 elements, the first of which is number 1900. To extract substrings in GW-BASIC, the MID$ ("*string*", *s*, *e*) function is used, where *s* is the starting position and *e* the ending. True BASIC instead offers the more-compact notation "*string*"[*s*:*e*]; thus "BASIC"[2:3] refers to the substring "AS". And where GW-BASIC lets you output edited numbers with the PRINT USING statement, True BASIC lets you assign an edited number to a string with the USING$(*format$*, *expr1*, *expr2*, . . .) function, after which you can continue to work with it inside the program.

GW-BASIC has no matrix functions and only poorly thought-out graphics functions. True BASIC has a full complement of matrix functions grouped under the MAT command, and rich graphics functions are available under the BOX command. True BASIC approaches the object-oriented style of programming when it allows modifiers on the "DRAW picture-subroutine" command that shift, scale, rotate, or shear the output of the named picture-generating subroutine.

Powerful facilities in the True BASIC environment include a command-driven editor that can display all instances of a particular string and do a global change with confirmation. The dialect offers editable script files that can store sequences of commands to be executed and, like DOS batch files, take arguments; one of these files is STARTUP.TRU, which True BASIC executes at start-up.

FOLLOWS OWN STANDARD

Some deviations from the Microsoft dialect will take getting used to if you were raised on GW-BASIC. The LOAD command, for instance, is called OLD; the SYSTEM command is BYE; KILL is UNSAVE. The MKDIR and RMDIR commands are gone, possibly to make True BASIC less DOS-dependent, since True BASIC programs run on Amigas, Atari STs, and Macs, as well as on PCs.

And syntax characters that no longer have the meaning you may expect include the apostrophe (which preceded comments in the original BASIC dialect), the plus sign (used for string concatenation), and the period (used to segment variable names). A large cursor now indicates replace mode, the .BAS extension is now .TRU, and neither integers nor double-precision floating-point numbers are supported.

True BASIC "compiles" your source into pseudocode rather than actual machine language, and the .EXE file it builds packages this pseudocode with its own runtime interpreter. Fortunately, there is no runtime charge, as there often is with many other language products.

Communications support is omitted from the base product but available as a separate $69 toolkit. Other kits include *Sorting and Searching*, *Forms Management*, *3-D Graphics*, *Business Graphics*, *Scientific Graphics*, *Mathematics* (with support for real numbers of up to 100,000 digits), *Advanced String Manipulation*, and an IBM PC developer's toolkit. The kits are 90 percent True BASIC source code, with the other 10 percent being highly optimized assembler code.

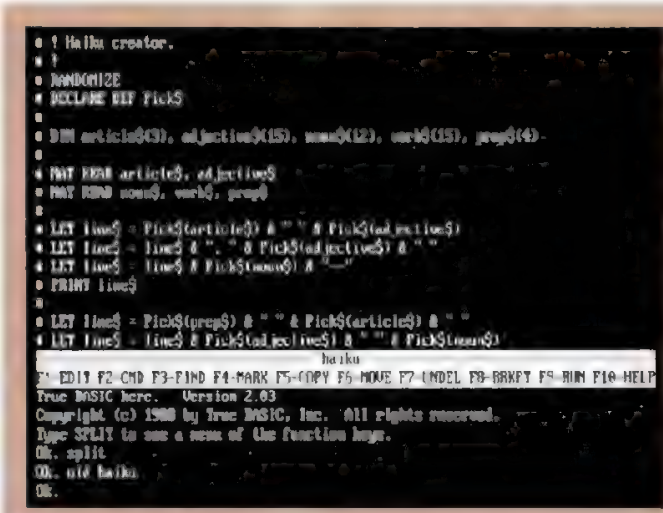
The latest release of True BASIC, Version 2.1, contains a number of important improvements, such as VGA support, a more powerful TRACE command, and completely rewritten documentation, but it still costs only $99.95.

If True BASIC were a business BASIC aiming for a different market than that currently dominated by Microsoft, the product might indeed be a major force. True BASIC, however, faces an uphill battle from its very compliance with ANSI—whose vision for the language has not matched the present abilities of Microsoft's product. Yet True BASIC excels in specific areas that remain untouched by the more popular products.

FACT FILE

True BASIC
True Basic Inc., 12 Commerce Ave., West Lebanon, NH 03784; (800) TR-BASIC, (603) 298-8517.
List Price: $99.95
Requires: 256K RAM, DOS 2.0 or 3.3. Hard disk recommended.
In Short: This p-code interpreter's strengths include command-driven editing and full matrix functions; compliance with the ANSI BASIC specification, however, may turn off some users.

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True BASIC's command-driven editor splits the screen into the program window and one in which you enter commands. The editor can display all instances of a particular string and can perform a global change with user confirmation.



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Turbo Basic 1.1

by Ethan Winer

If competition is good for the consumer, then Borland's introduction of Turbo Basic, Version 1.0, in early 1987 seemed a godsend. By adding a number of features not available in the market leader, Microsoft QuickBASIC 3.0, Borland added fuel to the BASIC wars, thus forcing Microsoft to improve its product.

Among the enhancements offered by the $99.95 Turbo Basic 1.0 were a number of important language extensions; added were long integers, binary file access, recursion, and fast screen printing. Equally important for many people, Turbo Basic programs automatically (and conveniently) accommodate a math coprocessor if one is present. Although QuickBASIC 3.0 can support a coprocessor, creating programs to include that feature is cumbersome.

All innovations aside, Turbo Basic 1.0 was excessively buggy. Several months after its release, Borland quietly began shipping Version 1.1, which fixed a number of these bugs at the same time that it added a few new features, such as support for Hercules graphics.

Like QuickBASIC, Turbo Basic 1.1 integrates a full-featured program editor with in-memory and on-disk compilation. Pull-down menus are used to manipulate the editor and for setting the various compiler options. True to its name, Turbo Basic will compile a program in memory very quickly. And because Turbo Basic does not require a separate link step when compiling to disk, that process is also extremely fast—much faster than with QuickBASIC. Eliminating the linker, however, makes it more difficult to incorporate external assembly language routines within a Turbo Basic program.

One very nice touch is Turbo Basic's ability to automatically resolve forward program references. With all versions of QuickBASIC, DEF FN functions must be defined before being referenced in a program; that is, the function definition must be physically positioned near the beginning of the source text. Turbo Basic does away with that requirement by scanning the program twice as it compiles.

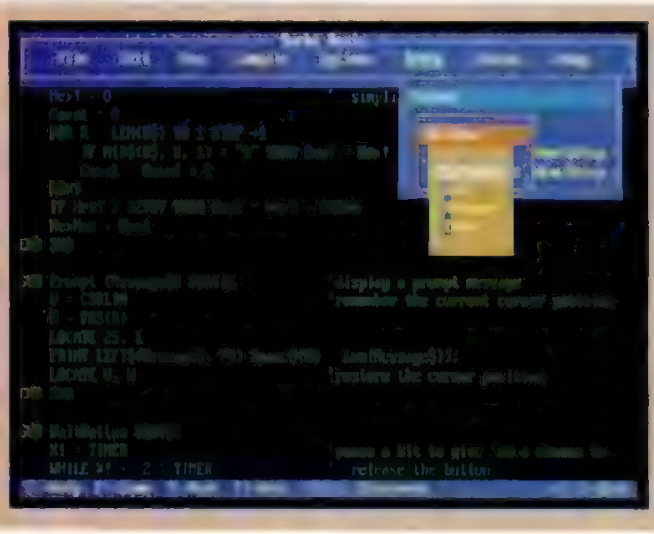
As important as Turbo Basic 1.1 is, most of the advantages it had over QuickBASIC all but disappeared when QuickBASIC 4.0 was introduced. Indeed, if we had to compare Turbo Basic 1.1 with the latest QuickBASIC, there would be no

FACT FILE



Turbo Basic 1.1
Borland International,
1800 Green Hills Rd.,
Scotts Valley, CA
95066; (408) 438-8400.
List Price: $99.95
Requires: 384K RAM,
DOS 2.0 or later.
In Short: Turbo Basic provides a modest performance improvement over QuickBASIC in several areas—most notably in math—but falls behind in overall ease-of-use and program debugging. Regrettably, Borland has banished hopes for later upgrades by cancelling the release of Version 2.0.

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The Turbo Basic editing environment features a classic *WordStar*-like editor and uses pull-down menus to control all of its compile and system functions. Customizing the color combinations is but one of Turbo Basic's many configuration options.

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contest. Especially in terms of its debugging environment, QuickBASIC 4.5 is clearly superior.

Unfortunately, as we went to press we received word that Borland has halted development of Turbo Basic 2.0. While Version 1.1 will continue to be fully supported, present users cannot expect any further upgrade of the product any time in the near future.

Watcom BASIC

by Ross M. Greenberg

Watcom BASIC's graphical interface—yes, graphical interface—is what really makes this $250 compiler/interpreter from Watcom Products stand out. It uses the GKS (Graphical Kernel System) standard developed by both the International Standards Organization (ISO) and the American National Standards Institute (ANSI). This is one powerful standard—there's not much you'd want to do with graphics that can't be done in Watcom BASIC.

An important consideration is Watcom's ability to create device-independent GKS-conforming programs. A program you write to display an image on your EGA can be used to output the same image to your plotter or laser printer without any programming changes. Any device dependencies (such as resolution, aspect ratio, or number of colors available) are handled internally by the graphics kernel. By simply changing the letters *CGA* to *EGA*, for example, I was able to run a Watcom graphics demo in the higher resolution with no other coding changes. And the circle it displayed on my EGA monitor is just as much a circle on my plotter, even though they have different aspect ratios that, if not handled properly, can make a circle look like an oval.



The Watcom BASIC editor is full-screen, allowing you to cut and paste either in a command mode or through direct cursor manipulation. An undo function allows you to erase any changes made to the current line.

Watcom BASIC's editor functions either in line mode or in full-screen mode and includes an undo function that allows you to erase any changes made to the current line.

The function keys are used for most editing functions—for instance, one brings up a help screen that displays a list of commands and any function key assignments you may have made (only Alt–function key combinations may be redefined). Personally, I prefer using my normal text editor, as I already know its command set.

SOME ODD FEATURES

Watcom has some odd ideas about how people program in BASIC; its version is sensitive to case in variables—that is, VARIABLE$ is not the same as variable$. Although programming languages like C provide the same level of frustration due to case considerations, the compiler in these languages generally won't let you get away with programming case errors. Watcom BASIC *does* let you get away with it; this can lead you to waste a substantial amount of time trying to debug code that should work but doesn't because of a simple case error.

Although the dialect's command set is rich and powerful, don't expect to be able to painlessly convert your code from other BASICs to Watcom BASIC. Many BASIC programmers, for instance, are used to the intrinsic function STR$(numeric_variable) returning the ASCII string representation of the value of numeric_variable. Not in Watcom. STR$() is a function much like the more traditional MID$() function, and the function VALUE$() is used in its stead.

You'll really have to sit down and study the manuals to get acquainted with these differences and to get the most out of the product. Fortunately, the manuals are among the best BASIC manuals I've seen—clearly written and well organized and indexed. Beginners will also find them to be good learning tools.

Watcom BASIC does have some problems to watch out for: when you exit from the interpreter, for example, the screen characteristics are not always reset to what they were before you started. The installation program was also unable to run to completion, owing to a missing label in the INSTALL.BAT script file. And, perhaps because of the device independence, I found the screen output to be a little slower than I had hoped for.

These quibbles aside, the combination of graphics capabilities, device independence, and useful command set, along with its editor and well-written manuals, makes Watcom BASIC a nice package for both experienced and inexperienced programmers. ■

Ross M. Greenberg is a frequent contributor to PC Magazine *and has been programming in C, BASIC, assembly language, and other languages since 1970. Stuart R. Greenberg is a senior programmer at PC Labs. Dean Hannotte is a data-processing consultant with more than 20 years of experience on mainframes, mini-*

FACT FILE



Watcom BASIC
Watcom Products, 415 Phillip St., Waterloo, Ontario, Canada N2L 3X2; (519) 886-3700.
List Price: $250
Requires: 256K RAM, DOS 2.1 or later.
In Short: Watcom BASIC's graphical user interface is what makes this compiler/interpreter really stand out. Some quirks and potential conversion problems plague the system, but its ample documentation will aid both the experienced and the novice programmer.

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EDITOR'S CHOICE

- Microsoft BASIC 6.0
- QuickBASIC 4.5

With BASIC languages more affordable than ever, there's no reason to turn to the GW-BASIC supplied with your PC for anything but the simplest programming tasks. And the combination of QuickBASIC 4.5 and Microsoft BASIC 6.0 is simply the most powerful BASIC development environment presently available. Between QuickBASIC's intelligent editor and wealth of debugging features, nothing else even comes close for simplifying a programmer's job.

Perhaps even more important are the innovative features Microsoft continues to add to the language. The current versions, for example, offer TYPE variables and arrays to help the programmer organize diverse data into a single entity. Equally important are QuickBASIC 4.5's support for multiple-module programs, an easy interface to assembly language routines, and an extensive on-line help system. It's also great for beginners, and—with more and more people becoming interested in programming for OS/2—Microsoft BASIC 6.0 is the only language for developing OS/2 programs.

Hedge Systems' PopBASIC is a pop-up BASIC interpreter—an unusual concept to begin with, but one that is carried out with finesse. When you consider the program's ability to quickly and easily create pop-up TSRs, combined with its overlay capabilities and low price, PopBASIC deserves an honorable mention.

computers, and PCs. Don Malin is vice president of Crescent Software in Stamford, Connecticut, which publishes tools and add-ons for compiled BASIC. He has been programming for 12 years. Jay Munro is a staff programmer at Crescent Software. Ethan Winer is a contributing editor of PC Magazine *and has been programming in BASIC and assembly language since 1981. He is also president of Crescent Software.*

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ILLUSTRATION: ALYTA MILANA

Now that remote-control software can work across a LAN, it can help software trainers and technical supports do their jobs. It's also helpful for supervising employees and sharing resources.

by Frank J. Derfler, Jr., and Pamela Watson

To paraphrase Shakespeare, some are born teachers, some achieve teaching, and some have teaching thrust upon them. PC managers and technical support people often fall into that latter category of teachers. Until recently, these often-reluctant instructors usually had to travel to the far corners of the organization, using "hovering over the shoulder" or "let me use the keyboard" modes of operation to aid their erstwhile pupils.

Now that remote monitoring and control software is available on local area networks, the task of such instructors may be simplified. By linking the screens and keyboards of one "master" PC to those of one or more PCs across a network, LAN remote-control software provides the next best thing to being there. Whatever appears on the screen of the monitored station also comes up on the screen of the machine doing the monitoring; keystrokes

sent from the monitoring machine affect the operation of programs on the monitored device.

Besides aiding PC trainers and those who provide technical support, these LAN-based remote-control products can be used for demonstration, to monitor job performance, to aid in the sharing of network resources, and even to help groups of people work together more efficiently. The link configuration these packages establish, coupled with the features that they provide, determines which applications they are best suited for (see topology diagram).

NEW TWIST

Remote-control software itself isn't new. Programs that let one PC remotely control another PC over a telephone line and modem—such as *Carbon Copy*, *Close-Up*, *pcAnywhere*, and *Remote*—have been available for years. The companies marketing these products compete hotly, and the list of features these programs offer grows and grows.

Remote-control software that works across a LAN, however, is relatively new. Brightwork Development's *NETremote* has roots that are several years old, but the copy of *Close-Up/LAN* we received was the first shrink-wrapped package Norton-Lambert shipped. *R2LAN*, from Crosstalk Communications, is just as new.

The fact that these products are in an undefined market shows in their lists of features and in their prices. Some programs (like Norton-Lambert's *Close-Up/LAN*), provide a long list of features and interesting user interfaces, while others (like *NETremote Plus*) do their job with few frills. Most serve an entire "network" or server for one cost, but *Close-Up/LAN* is priced according to the number of users. As we discussed these products with their designers, it became clear that no one is sure what new applications will emerge or how the packages should be priced. A dose of competition in an active market will provide a lot of insight.

The pricing of these products varies wildly. Some companies, for example Fresh Technology Group, are literally giving their software away at less than $200 per file server. In comparison, Crosstalk Communications charges slightly under $800 "per network" for its product. Perhaps companies that are selling packages at low prices still think that most local area networks have two or three users, but an ongoing PC LAN Labs survey of our readers with networks based on Novell's *NetWare* shows that 33 percent of the surveyed networks have more than 50 users on a single server.

LAN managers keep their jobs according to the success of their network and the products that are running on it. They understand the importance of technical support and they will pay for it. It is natural to wonder how much support a company can provide for a technically sophisticated software product when it sells the product for only $200 per network.

A daisy-chain connection takes place when a PC that's being monitored by one or more stations assumes the monitoring role and links to another PC with one or more established monitors.

ON SPEAKING TERMS

As with all software, terminology within LAN-based monitoring and control programs varies with the designer and the company. The terms companies use to describe the monitoring and monitored PCs vary from the clear-cut to the ridiculous. *Host* and *viewer*, *host* and *caller*, and *listener* and *caller* are common; *host* and *listener* refer to the station being monitored, while *viewer* and *caller* refer to the monitoring machines. The terms *master* and *slave*, used in *D-Link Screen Monitor*, may be objectionable to some would-be users.

The multiple connections (many-to-one, or one-to-many relationships—again, see topology diagram) available through these packages are unique to networked remote-control products. They provide a degree of flexibility that the RS-232C-based programs they sprang from can never match. In a classroom, for example, the one-to-many arrangement allows one instructor to view many students' work, and the many-to-one capability provides a way that the students can all watch an instructor's demonstration on their own monitors. Many of these products are capable of multiple sessions, which means that any of these activities, or merely several one-to-one sessions, can occur at the same time.

A daisy-chain connection takes place when a PC that's already being monitored by one or more stations simultaneously assumes the monitoring role and links to another machine with one or more established monitors. The screens of all the monitoring machines show the same display, but in reality it is the screen image replayed by an interim machine playing both the host and monitor roles. This capability is particularly useful for expanding a classroom or software demonstration beyond the 16-monitor limit of some of these programs.

APPLICATIONS/IMPLICATIONS

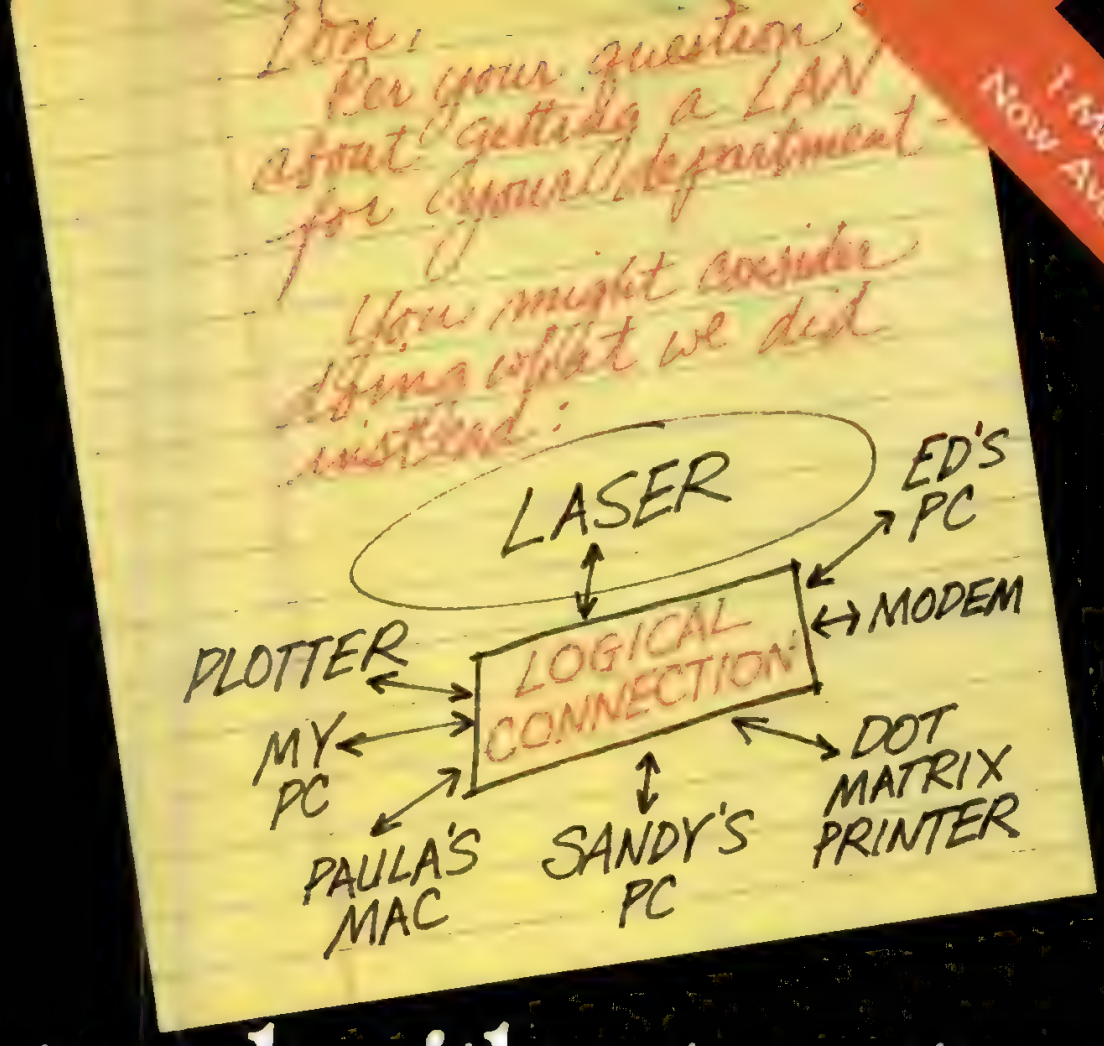
Like a telephone, two or more PCs or workstations must be on-line with the LAN-based monitoring and control program in order for either passive or aggressive viewing to take place. If your telephone is not plugged in, obviously it will not ring.

By "plugging in" to another PC or workstation, one person can instruct another in a particular program or help him or her through a procedure. Typically, the two people would talk on the phone and work on their screens at the same time. The instructor or troubleshooter would demonstrate the action or procedure by remotely controlling the student's program, CPU, and peripherals and explain the actions as they happen. Some packages include an on-screen "chat" feature that lets the two stations exchange typed notes in a pop-up window.

The one-to-many/many-to-one relationship is essential for organizations requiring traditional classroom settings, but not all products provide it. *Close-Up/LAN* and *The Network Eye* offer the most flexibility, allowing users to sign on as both monitored and monitoring network nodes. *NETremote* and *R2LAN* both offer only one-to-one relationships, but do allow for multiple sessions.

The many-to-one connection these packages provide can also be used for su-

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pervision. For some people, this usage of these products calls to mind all sorts of Orwellian nightmares of unseen monitors watching every keystroke. Indeed, some programs enhance the idea by using such terminology as "covert monitoring" and "masters, workers, and slaves."

REALITY CHECK

The reality of the situation isn't quite so sinister. First, the station being monitored must load a TSR program before any monitoring can take place. All of these packages, except for *D-Link Screen Monitor*, let the user set a password that the would-be monitoring station must use. Most of these programs, including MicroNet's *LANShare*, *D-Link Screen Monitor*, and DCA's *R2LAN* always provide either a visual or audio signal when monitoring begins. However, it is true that a person with the benefit of a lot of computer experience could use several of these programs to set up a remote monitoring system that would be quite invisible to an inexperienced computer user.

> In addition to all the other functions they provide, many of these LAN-based remote-control programs let you take advantage of networked equipment that isn't occupied at the moment.

Finally, in addition to all the other functions they provide, many of these LAN-based remote-control programs let you take advantage of networked equipment that isn't occupied at the moment. With LAN-based remote-control software, you can use the Postscript laser printer in the accounting department, the high-speed modem in the technical laboratory, and the 33 MHz-386 of the power user who is on vacation—and never leave the comfort of your own office. People who manage data-base programs particularly seem to like the idea of remotely starting one fast computer on the job of indexing a data-base while keeping their own machine available for other functions.

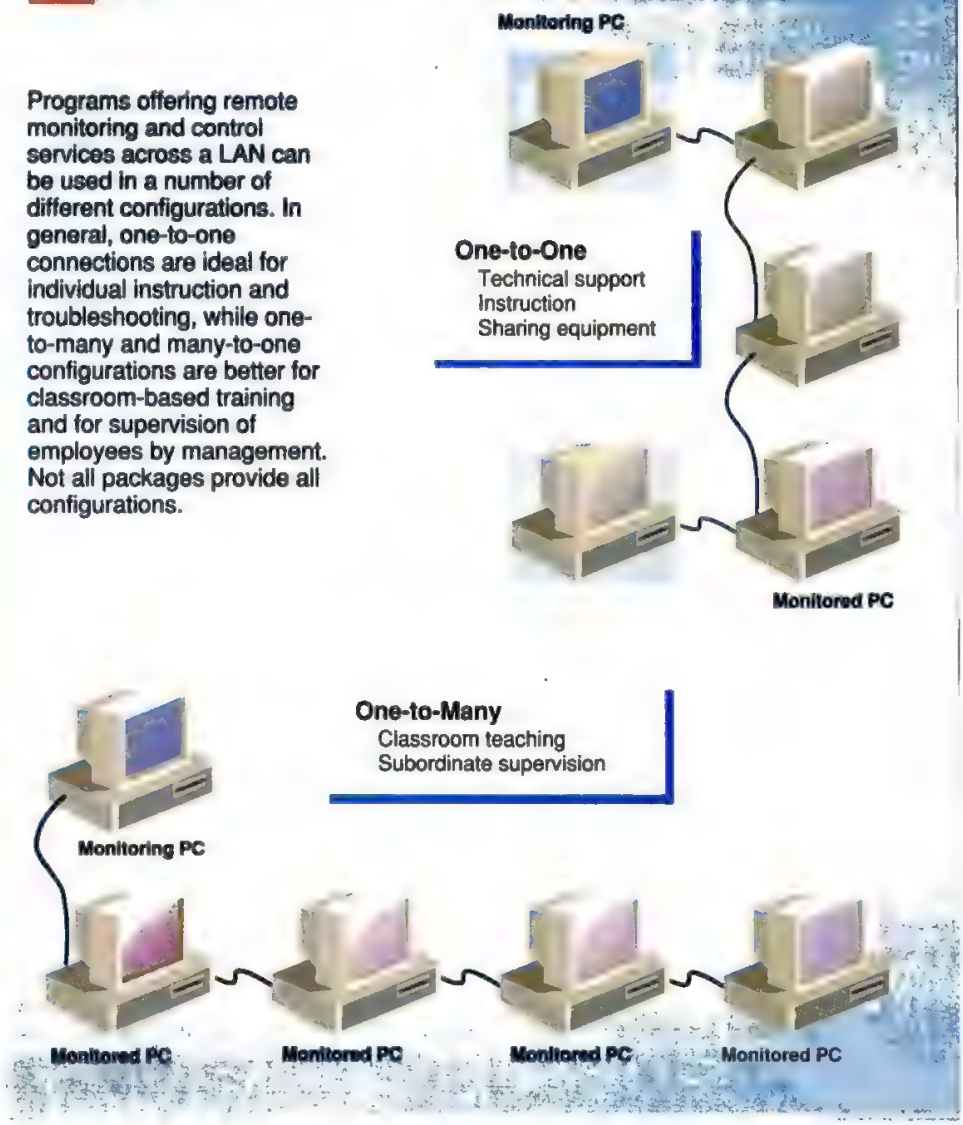
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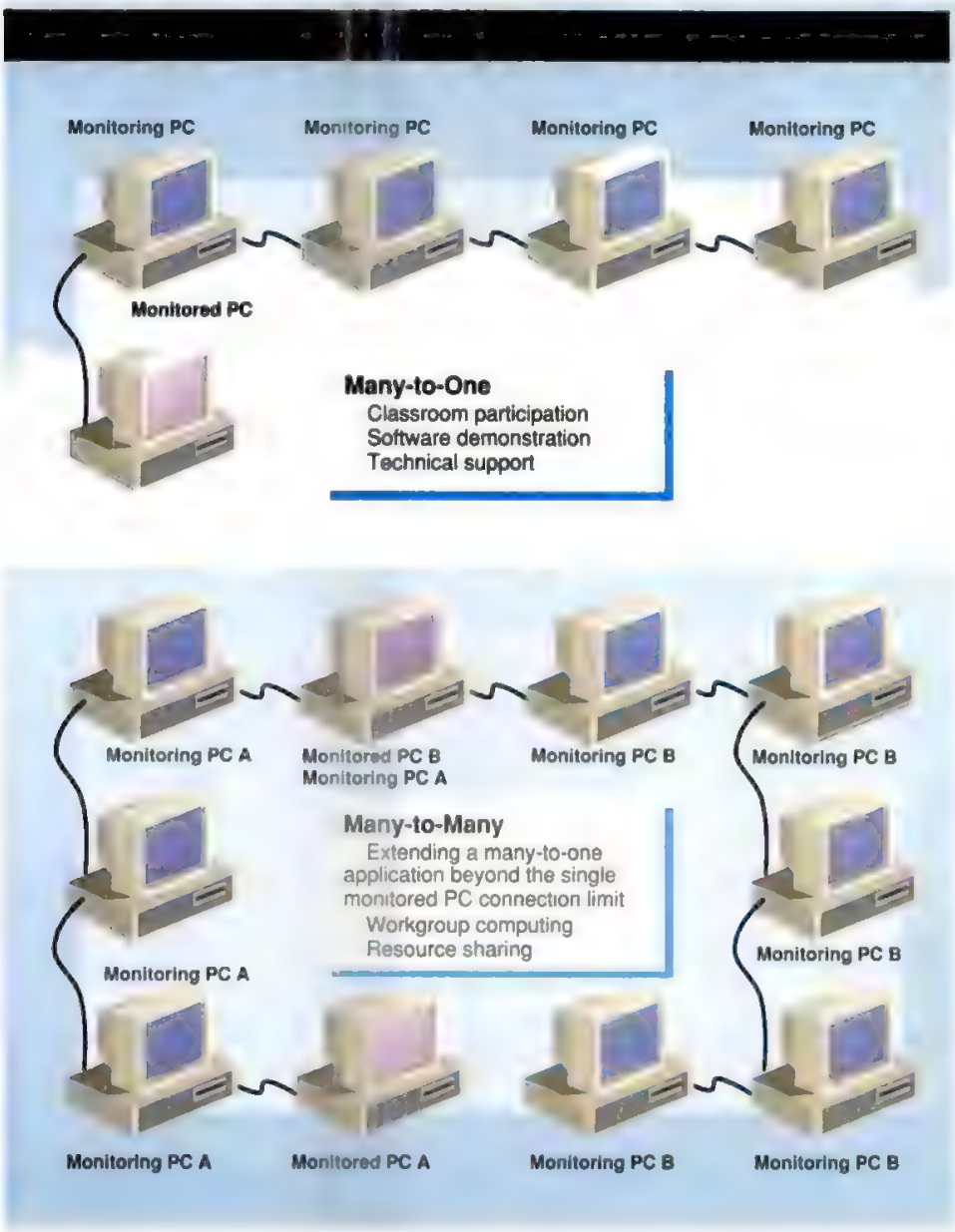
All of the programs reviewed here can transfer screens created by programs in the text mode, regardless of the type of monitor used to display the text. When programs actually operate in the graphics mode, however, the transfer process becomes a lot more complex.

Graphics screens contain exponentially more data than do text screens. Many factors—including how often the TSR samples the screen buffer of the monitored station, the amount of degradation acceptable to the performance of the monitored station, the transmission lag-time acceptable to the screen of the monitoring station, and how much and how often the graphics display changes—affect the ability to transfer graphic images between two machines in real time. Some of the packages we reviewed, like *The Network Eye*, don't even attempt to transfer graphic screens. Most of the packages we looked at can successfully handle EGA screens, but even those that claim to handle VGA screens, like *D-Link Screen Monitor* and *LANShare*, have

LAN REMOTE CONTROL: TOPOLOGY OPTIONS

Programs offering remote monitoring and control services across a LAN can be used in a number of different configurations. In general, one-to-one connections are ideal for individual instruction and troubleshooting, while one-to-many and many-to-one configurations are better for classroom-based training and for supervision of employees by management. Not all packages provide all configurations.





only limited success. This is a tough technical problem that hasn't been solved yet, but companies like Crosstalk Communications say they are hard at work looking for an answer.

To test how fast these programs could transfer both graphics- and text-based screen updates, among other things, we subjected the seven programs to a test suite devised by PC LAN Labs.

Items tested include the performance degradation a monitored station suffers from the background activities of the TSR monitor program, the time needed to transfer the change of just one character on the screen, and a measure of the amount of network traffic generated when just one character changes on the monitored screen. We also tested for the transfer of uncommon characters and events, like the ability of the monitoring stations to detect when the speaker on the monitored PC beeps.

One area of significant technical difference between these programs showed up in the amount of traffic they generate on the network.

Some remote control packages, like Artisoft's *The Network Eye*, send the contents of the monitored machine's entire video buffer across the network several times a second whether any character changes occur or not. Other packages, such as Norton-Lambert's *Close-Up/LAN*, will send characters across the network only when there is a change.

This difference in design means that one package might generate 40 network packets in a minute, while others generate more than 40,000 packets to do the exact same job. Whether you will actually notice the difference in terms of network performance depends on how busy your network is with other tasks. On Ethernet, ARCnet, and Token-Ring Network cabling systems, for instance, you could have many of these stations regularly dumping their entire screen buffers and not consume even 2 or 3 percent of the cable's total capability. However, on other, slower cabling schemes, this network load would be a significant detriment to the system's overall performance.

We tested and reviewed seven LAN-based remote monitoring and control packages with a wide range of capabilities, features, and prices. No single program is perfect for all situations, and no program has all the options available—although Norton-Lambert's *Close-Up/LAN* comes close. These programs are valuable, but you'll need to shop carefully to match the needs of your organization to the available feature sets.

Close-Up/LAN

All reviews by Patricia A. McGovern

The most complete and flexible of the LAN remote control and monitoring packages we reviewed, *Close-Up/LAN* is more than just a screen-monitoring program. Running with equal efficiency on local area networks based on Novell's *NetWare* and NetBIOS, the $795 (for eight users) version of this package from Norton-Lambert Corp. features extremely robust resource-sharing capabilities.

Close-Up/LAN allows users to engage in every combination of multiple-station monitored and monitoring operation; one-to-one, one-to-many, many-to-one, and many-to-many connections are all available.

It lets users establish themselves on both the giving and receiving ends of shared resources and support. With it, a *viewer* (as the package terms the user who does the monitoring or controlling) can be in the middle of helping someone with a software problem and request help from another user without having to exit the pro-



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Close-Up/LAN, from Norton-Lambert Corp., has pop-up menus that provide excellent flexibility during setup. The package, which costs $395 for two users and $795 for eight users, allows virtually any combination of host/guest relationships.

gram and run a separate *host* (the package's term for a station being viewed or controlled) software module. This giving-and-receiving capability also allows users to exceed the package's single-station limit of 16 connections by daisy-chaining.

Close-Up/LAN runs on either the Novell IPX or the NetBIOS network transport protocol. During installation, the product examines the network and decides which protocol is available, so you don't have to specify the drivers the package should use. Support for *Close-Up/LAN* begins with excellent documentation and continues with a technical support hotline.

Close-Up/LAN's Viewer program is a TSR that takes from 66K to 78K of RAM on a *NetWare* IPX network and from 86K to 98K of RAM using NetBIOS. You can hotkey in and out of *Close-Up/LAN* from any application; its pull-down menu displays the available hosts.

As a viewer, you have access to the resources of up to 16 PCs running the Host TSR. If you need to use the 386 machine and modem down the hall, you can easily connect to them as long as they're on the network, signed in as hosts, and give you permission. *Close-Up/LAN* is especially good at sharing the printers connected over wide area networks, allowing you to have multiple printing locations working simultaneously.

Whether the viewer is using the resources of a remote host or aiding a host in using software, the viewer-host connection can be made without disrupting the work at the host station. The host operator receives a beep when a viewer connects, but the screen and keystrokes on the host machine don't slow down an appreciable amount. For classroom purposes, the viewer's menu includes features for disabling the keyboard and screen of the host. The viewer's menu also allows you to switch back and forth between hosts easily and to end the connection between all or some specific hosts.

DEFENDING PRIVACY

With *Close-Up/LAN*, the host has the ability to defend his or her privacy. Loaded by the host TSR (which occupies up to 53K), the host's menu contains options to disconnect viewers from the host PC, to require a password, and to set up a private mode so that only designated viewers can access the host PC. You can save these options through the host's setup menu. As host, you have the power to initiate or terminate the connection, so you can request help from a viewer instead of waiting for one to call. The host's menu can also set up parameters so that viewers can view the host PC's screen but cannot use remote control. A total of 16 hosts can connect to one or more viewers.

The Dialog feature enhances *Close-Up/LAN* with its chat/communicate function. Once a user, either a viewer or a host, initiates a connection to another viewer or host, the Dialog option becomes available. Appearing as a 2-inch box on the screen (you can move it around if it appears in the way of the application you're viewing), the chat box does exactly what you'd expect, letting you converse without using the telephone.

Close-Up/LAN is especially good at sharing printers that are connected over wide area networks, allowing you to have multiple printing locations working simultaneously.

LEADER OF THE PACK

Our performance test results confirm *Close-Up/LAN*'s "leader of the pack" position. Like *D-Link Screen Monitor* and *LAN Assist Plus*, *Close-Up/LAN* samples the screen on the host machine and transmits only changes; it doesn't flood the network with unnecessary data. With *Close-Up/LAN*, you can change the "time slice," or sampling rate, of the host program. If the host's screen doesn't change

FACT FILE
EDITOR'S CHOICE

Close-Up/LAN
Version 2.0
Norton-Lambert Corp.,
P O Box 4085, Santa Barbara, CA 93140,
(805) 964-6767.
List Price: 2 users, $395; 8 users, $795; 16 users, $995; 32 users, $1,495; 64 users, $1,995
Requires: Host: 25K to 50K; Viewer: 66K to 76K; any version of Novell's *NetWare*, *3Com*, *AT&T StarLAN*, *IBM PC Local Area Network*; any version of Microsoft *LAN Manager* or other network operating system with .IPX or NetBIOS services, DOS 2.0 or later.
In Short: An impressive monitoring/remote-control package featuring combinations of one-to-many, many-to-one, and many-to-many relationships. The package is easy to install on either IPX or NetBIOS networks and has a long list of features. With near-seamless interaction, *Close-Up LAN* provides excellent network support and resource sharing with minimal traffic load on the network.

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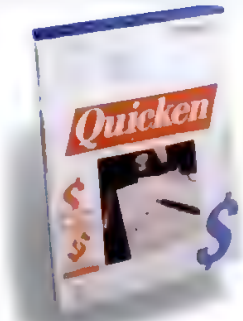
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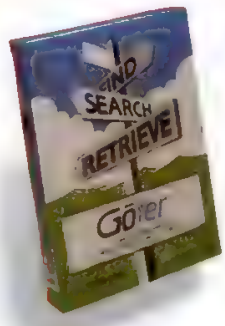
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4929 □Close-Up Support 3.0 ..... 165.
5420 ▣Close-Up LAN *(8 user)* ..... 529.
On Track Computer Sys. ... NCP
5490 ▣Disk Manager 4.0 ..... 65.
Owl International ... NCP
3080 □Guide 2.0 ..... 143.
Paperback Software ... NCP
3142 □VP-Planner Plus 2.0 ..... 145.
3138 □VP-Expert 2.02 ..... 145.
Personics ... NCP
3126 ▣SeeMORE 2.0 ..... 54.
4328 ▣Look & Link 1.1 ..... 59.
4384 □Ultravision 1.2 ..... 79.
3124 ▣ATBASE 1.22 ..... 119.
Peter Norton ... NCP
3152 ▣Norton Commander 2.0 ..... 52.
3146 ▣Advanced Utilities 4.5 ..... 89.
3153 ▣Norton Editor 1.3 ..... 45.
4150 ▣Dan Bricklin's Demo Prog. 2 2B ..109.
Quarterdeck ... NCP
3221 □Expanded Memory Mgr. 386 4.2 . 39.
3220 □DESQView 2.24 ..... 79.
4586 □DESQView 386 1.0 ..... 115.
Reference Software ... NCP
4396 ▣Grammatik III 1.1 ..... 52.
Revolution Software ... NCP
4480 ▣VGA Dimmer 2.01 *(screen saver)* . 19.
3254 ▣Cruise Control 3.02 ..... 39.
Rightsoft ... NCP
4155 ▣Rightwriter 3.1 ..... 54.
Samna ... NCP
5148 □Ami 1.0A ..... 129.
Simon & Schuster ... NCP
3314 □Typing Tutor IV 1.0 ..... 33.



Software Publishing ... NCP
▣*Harvard Graphics 2.12*–The industry's best selling presentation graphics package because of its smooth integration of text, charts, graphics, drawings and high quality delivery of output ..... $299.

Softlogic Solutions ... NCP
3546 □Disk Optimizer 4.01 ..... $45.
3542 □Software Carousel 3.0 ..... 55.
Software Publishing ... NCP
3495 ▣Professional Plan 1.02 ..... 59.
3499 □PFS:First Publisher 2.1 ..... 79.
4342 ▣PFS:First Graphics 1.0 ..... 89.
3478 ▣PFS:First Choice 3.02 ..... 99.
3496 ▣Professional Write 2.1 ..... 139.
3493 ▣Professional File 2.01 ..... 189.
3482 ▣Harvard Graphics 2.12 ..... 299.
4669 ▣Harvard Graphics Access. Pk 1.0 299.
4284 ▣Harvard Project Manager 3.0 ... 439.
Spinnaker ... NCP
4441 □Resume Kit 1.29 ..... 25.
4446 □8-in-1 1.15 ..... 39.
4444 ▣Splash 1.0 ..... 59.



Microlytics ... NCP
□*GOfer 2.0*–The original, affordable, simple, painless, quick, easy, and fast text-retrieval software package for IBM PC and compatible computers ..... $45.

Springboard ... NCP
3534 □Newsroom Pro 1.0 ..... 27.
Symantec ... NCP
4732 ▣SQZ!Plus 1.11 ..... 65.
3427 ▣Q & A Write 1.01 ..... 129.
3412 ▣Grandview 1.0 ..... 189.
3425 □Q & A 3.0 ..... 219.
3431 □*Breakthrough* Timeline 3.0 ..... 369.
T/Maker ... NCP
5540 ▣ClickArt Business Images ..... 45.
4185 ▣Scrapbook+ 1.0 ..... 85.
TOPS ... NCP
3724 ▣NetPrint 2.0 *(share printers)* .... 119.
3726 ▣TOPS 2.1 ..... 115.
3725 TOPS Repeater *(network extender)* 129.
3720 *Flashcard 2.1 (AppleTalk network card; 1 year warranty)* ..... 159.
Traveling Software ... NCP
4190 Battery Watch 2.0 *(3½" only)* ..... 35.
3729 ▣LapLink Mac 2.0 *(Mac-PC transfer)* 79.
5179 ▣LapLink III ..... 85.
4891 ▣ViewLink 1.0 ..... 95.
3727 ▣DeskLink 2.21 ..... 99.
True BASIC, Inc. ... NCP
3561 ▣True BASIC 2.1 ..... 52.
Vericomp ... NCP
3765 ▣SoftBytes 2.0 ..... 35.

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5046 ■ Volkswriter 4 *(w/Correct Grammar)* 109.

WordPerfect Corp. ... NCP

3799 ■ WordPerfect Library 2.0 ..... 75.
3798 ■ WordPerfect Executive 1.0 ..... 145.
3804 □ WordPerfect 5.1 ..... 265.
3805 ■ WordPerfect Network 5.1 ..... 389.
3806 Additonal Network Stations 5.1 .... 89.

WordStar USA ... NCP

2825 □ WordStar Prof. Release 5.5 .... 229.
5000 □ *Upgrade to Release 5.5* ..... 89.

Wordtech ... NCP

3810 □ DBXL 1.3 ..... 145.

Xerox ... NCP

4539 ■ Professional Extensions 1.0 .... 399.
3812 □ Ventura Publisher 2.0 ..... call

XTREE Co. ... NCP

4512 ■ XTREE Pro 1.1 ..... 69.

XYQUEST ... NCP

4393 □ XyWrite III Plus 3.55 ..... 229.

RECREATIONAL/EDUCATIONAL

Broderbund ... CP

1413 □ Where/World Carmen Sandiego? .. 25.
1414 □ Where/USA Carmen Sandiego? ... 25.
1417 □ Where/Europe Carmen Sandiego? 29.
4948 ■ JetFighter *(by Velocity)* ..... 35.

Electronic Arts ... CP

5698 □ Abrams Battletank ..... 29.
5699 □ Indiana Jones Graphic Adventure 35.
4804 ■ Life and Death ..... 35.
4659 ■ Chessmaster 2100 ..... 35.
5700 ■ Cribbage/Gin King ..... 42.

Microprose ... CP

4454 □ F-19 Stealth Fighter ..... 39.
2725 □ F-15 Strike Eagle ..... 22.

Microsoft ... NCP

2858 □ Flight Simulator 3.0 ..... 35.

Mindscape ... CP

4897 □ Gauntlet ..... 29.
2752 ■ Balance of Power 1990 ..... 33.

Parlor Software ... CP

3159 □ Bridge Parlor 2.3 ..... 49.

Sierra On-Line ... CP

3405 ■ Thexder ..... $24.
4752 ■ Gold Rush ..... 25.
4455 ■ Leisure Suit Larry II ..... 33.
4345 ■ King's Quest IV *(512k version)* ... 33.
5695 ■ Manhunter: San Francisco ..... 33.
4456 ■ Police Quest II ..... 33.
3404 ■ Space Quest II ..... 33.

Spectrum Holobyte ... NCP

3467 ■ Tetris *(addicting mind teaser)* .... 24.
4283 ■ Falcon/AT *(F-16 simulation)* ..... 32.
5187 ■ VETTE! ..... 32.

Stone & Assoc. ... NCP

3436 ■ Memory Master *(ages 2-6)* ..... 22.
3435 ■ My Letters,Numbers,Words *(2-6)* 22.
5231 ■ Phonics Plus ..... 22.
3439 □ 2nd Math *(ages 7-16)* ..... 27.

Sublogic ... NCP

4653 □ Up Periscope ..... 25.
3335 □ Jet *(requires CGA or EGA)* ..... 33.

True BASIC, Inc. ... NCP

3559 ■ Algebra 3 with Workbook ..... 39.
3590 ■ Pre-calculus ..... 39.



True BASIC, Inc. ... NCP

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Each with Workbook ..... $39.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

AST Research ... 2 years

1223 I/O Mini 2 C/S/P ..... 89.
1302 SixPakPlus 64k C/S/P ..... 129.
4107 RAMpage Plus 286 512k ..... 419.
4105 RAMpage Plus MicroChannel 512k 469.

Central Point ... 1 year

5042 Copy II PC Deluxe Option Board .. 115.

Compucable ... 2 years

1604 2-Position switch box ..... 25.
1605 3-Position switch box ..... 35.

Cuesta ... 1 year

1608 Datasaver 400 Watt *(power backup)* 429.

Curtis ... lifetime

1681 Curtis Clip CC-1 ..... $6.
1686 Disk Holder DB-1 ..... 8.
1718 3½" Disk Holder DB-2 ..... 8.
1704 Printer Stand PS-1 ..... 18.
1713 Filtered SafeStrip SPF-3 ..... 24.
1678 Universal System Stand SS-3 ..... 25.
1694 Emerald SP-2 ..... 36.
1707 Ruby SPF-2 *(6 outlets; EMI/RFI filtered; 6 ft cord)* ..... 55.
1708 Ruby-Plus SPF-2 Plus *(w/FAX & modem protection)* ..... 65.

DacEasy ... 1 year

3211 Breakthru 286-8 *(8 MHz accelerator)* ..... 225.
3210 Breakthru 286-12 *(12 MHz accelerator)* ..... 349.

Epson ... 1 year

We are an authorized Epson Service Center.

1906 FX-850 *(80 col., 264 cps, 9 pin)* ... call
1904 FX-1050 *(136 col., 264 cps, 9 pin)* .. call
5183 LQ-510 *(80 col., 180 cps, 24 pin)* .. 349.
1930 LQ-850 *(80 col., 264 cps, 24 pin)* .. call
4117 LQ-950 *(110 col., 220 cps, 24 pin)* .. call
1917 LQ-1050 *(136 col., 264 cps, 24 pin)* call
4116 LQ-2550 *(136 col., 333 cps, 24 pin)* call
5184 LX-810 *(80 col., 180 cps, 9 pin)* ... 199.
1052 Printer-to-IBM cable *(6 feet)* ..... 15.

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5th Generation ... 1 year

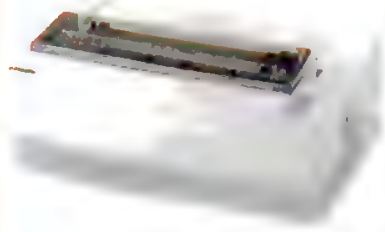
3952 Logical Connection 512k ..... 529.
4921 Logical Connection 1 Meg ..... 659.

Hayes ... 2 years

2304 Smartmodem 1200 ..... 289.
2305 Smartmodem 1200B *(w/Smartcom II)* 289.
2306 Smartmodem 1200B *(hardware only)* 259.
2307 Smartmodem 2400 ..... 429.
2308 Smartmodem 2400B *(w/Smartcom II)* 429.
2309 Smartmodem 2400B *(hardware only)* 399.

Hercules ... 2 years

2318 Graphics Card Plus ..... 189.
5120 VGA Card ..... 189.



Epson ... 1 year

LQ-510 Printer–Makes high quality 24 pin printing affordable. Includes push tractor and Epson's exclusive SmartPark paper handling features standard. 180 cps draft, 60 cps LQ (12 cpi mode) ..... $349.

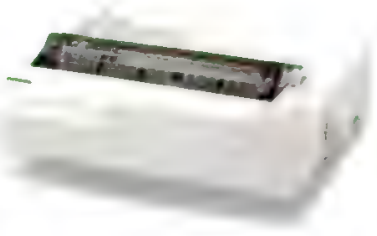
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Intel ... 5 years

4696	2400B Internal Modem	$159.
2352	2400B Internal Modem 2 *(for PS/2)*	249.
5119	2400 Baud External Modem	179.
2346	Inboard 386/PC w/1 Meg	599.
4646	Inboard 386/PC Piggyback 4 Meg	1249.
2339	Inboard 386/AT *(req. inst. kit)*	859.
2338	Inboard 386/AT Installation Kit	139.
4266	Above Board Plus 512k	419.
4267	Above Board Plus I/O 512k	449.
5336	Above Board Plus 8 2 Meg	869.
5342	Above Board Plus 8 I/O 2 Meg	899.
4272	Above Board 2 Plus 512k	469.
4339	Above Board Plus Piggyback w/2 Meg *(upgrades to 6 Meg)*	call
4275	Connection Coprocessor	769.
4857	Visual Edge *(improve the output of your HP Laserjet II)*	449.
	MATH COPROCESSORS	
2375	8087 *(for IBM-PC & XT)*	89.
2374	8087-2 *(for 8 MHz 8088 CPU's)*	129.
2368	80287 *(for 6 MHz 80286 CPU's)*	135.
2370	80287-8 *(for 8 MHz 80286 CPU's)*	199.
2369	80287-10 *(for PS/2 Models 50 & 60)*	229.
4750	80387SX *(for 80386SX CPU's)*	309.
2371	80387 *(for 16 MHz 80386 CPU's)*	349.
2372	80387-20 *(for 20 MHz 80386 CPU's)*	399.
4121	80387-25 *(for 25 MHz 80386 CPU's)*	499.



Epson ... 1 year

LX-810 Printer–A high speed 9 pin printer perfect for the home, or as a second printer for the office. Includes SmartPark paper handling features. 180 cps draft, 30 cps NLQ (12 cpi mode) ..... **$199.**

Kensington Microware ... 1 year

2581	Masterpiece	94.
2582	Masterpiece Plus	109.
4972	PowerTree 10	19.
4973	PowerTree 20	27.
4974	PowerTree 50	54.
5697	Expert Mouse *(Trackball for PS/2)*	115.

Key tronic ... 3 years

2537	101 Keyboard	99.
4518	101 Plus Keyboard	99.

Kraft ... 5 years

2603	3 button Joystick	25.
4292	3 button Joystick w/game adapter	49.

KYE International ... lifetime

4127	Dyna Mouse GM6+ *(w/Dr. Halo III)*	49.
4675	GM6000 Mouse *(350-1050 dpi)*	59.



Intel ... 5 years

Inboard 386/PC–Gives new life to your aging PC or XT system with its 16Mhz 80386 processor and 1Mb of memory standard. Optional 1, 2, or 4Mb piggyback expansion available ..... **$599.**

Logitech ... limited lifetime

5464	Series 2 Mouse *(C9 for PS/2's)*	65.
4388	ClearCase Mouse *(serial only)*	69.
5151	HiREZ Mouse *(C9)*	85.
5152	Mouse w/Paint Show *(C9)*	99.
4297	ScanMan *(hand held scanner)*	185.

Magnavox ... 2 years

4758	13" CGA Monitor *(8CM515)*	269.
4760	13" Hi-Res Monitor *(9CMO53)*	369.
4761	13" VGA Monitor *(9CMO62)*	389.
4762	13" VGA Monitor *(9CMO82)*	449.

Microsoft ... lifetime

2870	Mach 20 *(1 year warranty)*	349.
2897	Mouse with Paintbrush	109.
2896	Mouse with Easy CAD	125.
2898	Mouse with Windows 286 2.1	139.

Mouse Systems ... lifetime

2812	OmniMouse *(serial only; 1 year wrty)*	39.
4306	PC Mouse II w/PC Paint+	89.

NEC ... 2 years

4799	Multisync 2A *(VGA Monitor)*	499.
5085	Multisync 3-D Monitor	699.

Orchid Technologies ... 4 years

3069	Tiny Turbo 286 *(accelerator board)*	219.
4765	Designer 800 VGA *(360 x 480)*	249.
4690	ProDesigner VGA *(800 x 600)*	310.

Pacific Rim ... 1 year

5010	1.2 Meg External *(for PS/2's)*	215.
5011	360k External 5¼" Drive	179.

PC Power & Cooling Sys. ... 1 yr

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3202	Turbo Cool 150 *(25° - 40° cooler)*	129.
3205	Turbo Cool 250 *(25° - 30° cooler)*	169.
3200	Silencer 150 *(84% noise reduction)*	115.
3201	Silencer 200 *(69% noise reduction)*	129.
4514	Turbo Cool 375	299.

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Practical Peripherals ... 5 years

3101	1200 Baud Internal Modem	$69.
3100	1200 Baud External Modem *(mini)*	77.
4149	P/Link *(extends par. print signal)*	109.
3097	Microbuffer Inline *(par. print buffer/32k)*	135.
3103	2400 Baud Internal Modem	139.
3102	2400 Baud External Modem	179.
5285	2400 Baud External MNP Modem *(Level 5)*	209.
4542	2400 Baud Internal Modem for PS/2	229.

Princeton Graphics ... 1 year

3166	Ultrasync *(800 x 600 max. res.)*	549.

Quadram ... 1 year

5143	JT-FAX 9600	549.

Safe Power Systems ... 2 years

4561	Safe 250W *(standby power bkup)*	249.
4562	Safe 425W *(standby power bkup)*	369.
4563	Safe 500W *(standby power bkup)*	495.

SOTA Technology ... 2 years

5107	Floppy Drive Controller *(S/P)*	99.
5109	SOTA VGA/16 *(with 256k)*	259.
5111	SOTA 286i-12 *(12 MHz accelerator)*	299.
5402	SOTA 386i-16 *(16 MHz accelerator)*	419.

Targus ... lifetime

4899	Nylon Laptop carrying case	55.
4901	Leather Laptop carrying case	139.

TheComplete PC ... 2 years

4889	TheComplete Hand Scanner 400	159.
5598	TheComplete Half Pg. Scanner 400	189.
4885	TheComplete Answering Machine	219.
4887	TheComplete FAX 9600	429.
5140	TheComplete Page Scanner	549.

Toshiba ... 1 year

3684	T1000 Laptop *(80C88, 6.4 lbs.)*	669.
3681	T1000 768k Memory Card	289.
4856	T3100E Laptop *(12 MHz, 20 Meg)*	2749.
4958	T1600 Laptop *(12 MHz, 20 Meg)*	3249.

Video 7 ... 5 years

3776	VEGA Deluxe *(supports 640x480)*	219.
3778	VEGA VGA	259.
4193	FastWrite VGA *(includes 256k)*	319.
4194	VRAM VGA *(includes 256k)*	469.



Kensington ... 1 year

Expert Mouse–Takes mouse technology a step further with its unique ergonomic design. Moving the ball instead of the whole mouse saves valuable desk space. Automatic acceleration gives smooth & effortless cursor control. . **$115.**

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2485 Bernoulli II Single 20 Meg Internal $767.
5116 Bernoulli II Single 44 Meg Internal 995.
2486 Bernoulli II Dual 20 Meg External 1659.
5117 Bernoulli II Dual 44 Meg External 1969.
4276 20 Meg Cartridge Tripak *(5¼")* . . . 169.
5113 44 Meg Cartridge Tripak *(5¼")* . . . 249.
CONTROLLERS (required)
2499 PC2 Card . . . . . 169.
2500 PC2B Card *(bootable card for PC/XT/AT)* . . . . . 229.
2502 PC4 Card *(for PS/2 Model 50/60/70/80)* . . . . . 299.

Mountain Computer ... 1 year

2917 40 Meg Internal Tape Drive . . . . . 379.
2915 40 Meg External Tape Drive . . . . . 479.
2916 40 Meg External Tape Drive with Power Supply . . . . . 569.
5378 60 Meg External Tape Drive with Power Supply . . . . . 1169.
5616 150 Meg External Tape Drive with Power Supply . . . . . 1495.
5499 80 Meg Internal Tape Drive . . . . . 519.
5503 80 Meg External Tape Drive . . . . . 629.
5190 40 Meg Data Cartridges *(pre-formatted)* . . . . . 35.

Plus Development ... 2 years

3105 Hardcard 20 Meg *(49 ms)* . . . . . 549.
3106 Hardcard 40 Meg *(28 ms)* . . . . . 699.
5164 Impulse 40 Meg Int. Drive *(12 ms)* 659.
5165 Impulse 80 Meg Int. Drive *(12 ms)* 879.
5163 Impulse Controller *(required)* . . . . 229.

Seagate ... 1 year

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2285 20 Meg Internal Hard Drive ST225 *(w/controller and cables, 65 ms)* . . 289.
2286 30 Meg Internal Hard Drive ST238 *(w/controller and cables, 65 ms)* . . 299.
4554 40 Meg Int. HD ST251-1 (28 ms) . $359.
4624 80 Meg Int. HD ST4096 (28 ms) . . 619.

TEAC ... 1 year

4950 PC, XT 360k Drive *(5¼")* . . . . . 79.
4951 720k Drive *(specify XT or AT, 3½")* . 79.
4670 1.44 Meg Drive for XT *(3½")* . . . . . 99.
4326 1.44 Meg Drive for AT *(includes Bastech software utilities, 3½" copy prot.)* . 119.

Toshiba ... 1 year

3650 AT 360k Drive *(5¼")* . . . . . 85.
3649 AT 1.2 Meg Drive *(5¼")* . . . . . 99.
4755 AT 1.44 Meg Drive *(3½", includes Bastech software utilities)* 119.

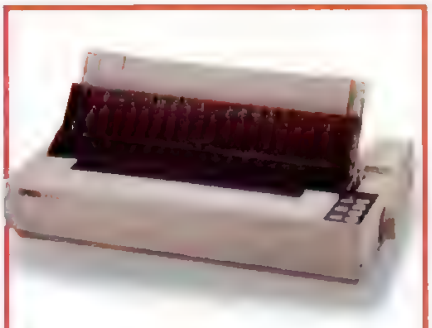
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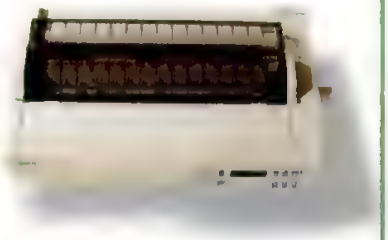
1676 CompuServe Information Service . . 24.

Cables ... lifetime

1019 Smartmodem-to-AT cable *(9 feet)* . . 15.
1050 Parallel Printer cable *(15 feet)* . . . . . 19.



Epson ... 1 year
FX-1050 Printer—Feature laden 136 column, 9 pin dot-matrix printer. SmartPark mode loads single sheets without removing continuous form paper. Prints 264 cps draft and 54 cps letter quality (12 cpi mode) . . . . . call



Epson ... 1 year
LQ-2550 Printer—A full-featured 24 pin, 136 column printer. Includes 7 built-in fonts, push tractor, and advanced paper handling. 333 cps draft, 111 cps LQ (12 cpi mode). call

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All disks have a lifetime warranty.

5¼" DS/DD Disks *(360k)*

3291 Sony *(10 disks per box)* . . . . . 12.
2789 Maxell MD2-D *(10 disks per box)* . . . 13.
4192 Verbatim Datalife *(10 disks per box)* . 13.

5¼" DS/High Density Disks *(1.2 Meg)*

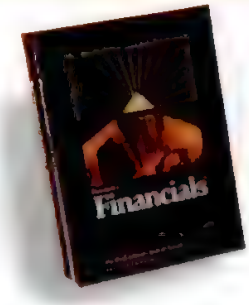
3770 Verbatim Datalife *(10 disks per box)* . 19.
3292 Sony *(10 disks per box)* . . . . . 19.
2790 Maxell MD2-HD *(10 disks per box)* . 19.

3½" DS/DD Diskettes *(720k)*

3297 Sony *(10 disks per box)* . . . . . 15.
3772 Verbatim *(10 disks per box)* . . . . . 15.
2792 Maxell *(10 disks per box)* . . . . . 16.

3½" DS/High-Density Diskettes *(1.44 Meg)*

3298 Sony *(10 disks per box)* . . . . . 32.
3773 Verbatim *(10 disks per box)* . . . . . 32.
2793 Maxell *(10 disks per box)* . . . . . 32.



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3248 256k DRAMs *(120 nanosecond)* . . . call
3241 256k x 9 SIMMs *(100 nanosecond)* call
4366 1 Meg x 9 SIMMs *(100 nanosecond)* call
5510 1 Meg x 9 SIMMs *(80 nanosecond)* call
4705 1 Meg Chips *(100 nanosecond)* . . . call

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- For all other items, add $3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

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- Call 603/446-3383 for information.

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PC Construction.

Using the old beam.
(Or, how we learned to log on.)

It takes a lot of lumber to run a computer mail order business here in the high rise hamlet of Marlow, NH (pop. 560). In fact, we recently started construction of a new sales and distribution center. Inspired by our well-built mascots, we've cleared ten acres, put in a new road, dug a pond, and are getting as much done as possible before winter. (At which time any tools you drop outside are lost until spring).

Fast stud service!

Admittedly, we've kept the local carpenters pretty busy since 1982, when we had them put some shelves in a closet to create our first warehouse. They've already restored the stately Christmas Tree Inn (c. 1833) to serve as our headquarters and conference center, rebuilt the dam out front, and even created a state-of-the-art TV production studio.

And what, you may ask, do all those sticks, stones, bricks, bracks, tongues and grooves rest upon?

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often, you can set a low sampling rate and leave the performance of the host's CPU relatively unaffected.

Given all of the features it offers as well as its impressive performance, you'd expect to pay a lot for *Close-Up/LAN*—and indeed, it is probably the most expensive package we reviewed. It is the only product to be sold "per user," so its price can't be compared directly with the prices of its competition, but the most expensive among the others is $795, and while *Close-Up/LAN* starts at $395 for two users, it costs $795 for eight users, $995 for 16, $1,495 for 32, and $1,995 for 64. Meanwhile, you could have 64 users on any of the other "per LAN" priced products for $795 or less.

Nonetheless, we believe that *Close-Up/LAN*'s pricing is justified by its capabilities, its likely longevity, and by the high level of support Norton-Lambert makes available. It is an excellent choice for any workgroup requiring everything today's monitoring and control packages are able to provide.

D-Link Screen Monitor

Designed for interventionary teaching and supervisory monitoring on networks using Novell's *NetWare*, *D-Link Screen Monitor* from D-Link Systems specializes in one-to-many connections. The $395 package, which runs only with *NetWare*'s IPX or D-Link's own *LANsmart* network operating system, allows one *master* to completely control up to 256 *slaves*.

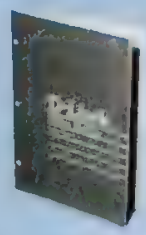
The master/slave terminology used by this program to describe the monitor/monitored relationship makes it easy to guess which of the two has the power advantage in the program. The program gives the master station three kinds of access to slave stations. It can broadcast a message to them, view their screens without control, or completely control their processors and screens. Slaves have no options and no control over being monitored.

The viewing functions of this program are particularly advanced. Just as a security system can successively display the images on the television cameras stationed around a building, *Screen Monitor* can successively monitor the screens of a group of slave stations. Called Cyclic Monitoring, this feature gives a master station the ability to pause at any particular slave's screen and then continue the monitoring. You can adjust the scanning rate and temporarily remain at any one screen, resuming the set rate with a keystroke. If you want to draw attention to one particular screen while you are in Cyclic Monitoring, touching the F1 key sends that particular screen to all of the slave terminals within the specified group. Additionally, *Screen Monitor* supports CGA, EGA, and VGA graphics.

The Remote Control function does exactly what its name says. While using Remote Control, the master station has complete control over the slave station, and keystrokes made on the master keyboard pass to programs running on the slave. Only one slave can be remotely controlled at a time.

Slaves are always made aware that they are being viewed or controlled. Any time a slave is being viewed by the master, a beep sounds every few seconds. Monitoring also reduces the speed of the slave PC's processing noticeably. In fact, according to our performance tests *Screen Monitor* slows down the monitored station's speed more than any of the other remote-control programs—the speeds of the processor and video BIOS are reduced by about half,

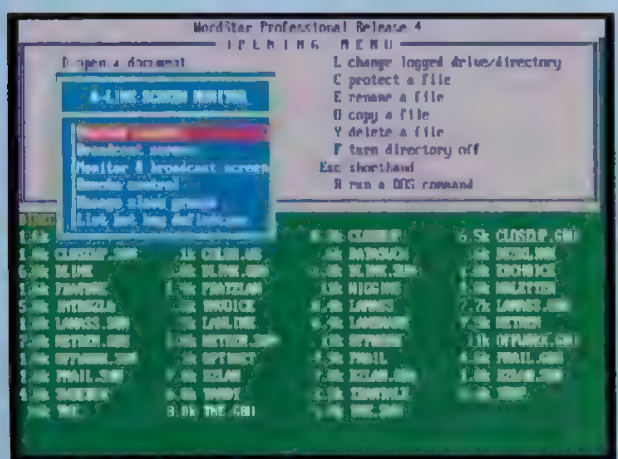
FACT FILE



***D-Link Screen Monitor*, Version 5.0**
D-Link Systems Inc., 3303 Harbor Blvd., Suite E-8, Costa Mesa, CA 92626; (714) 549-7942.
List Price: $395 (Allows for only one active master station; buying more packages does not allow activation of more master stations).
Requires: Master: 75K RAM; Slave: 40K RAM; IPX services from Novell's *NetWare* or D-Link's *LANsmart* network operating System; DOS 3.0 or later.
In Short: Offers remote control and broadcasting with a one-to-many relationship on IPX networks. *D-Link Screen Monitor* could work well in a classroom or an office where only one supervisor in a group needs control and resource-sharing power.

CIRCLE 607 ON READER SERVICE CARD

Just as a security system can successively display the images on the television cameras stationed around a building, *Screen Monitor* can display the screens of all the slaves.



D-Link Screen Monitor ($395 per network installation) specializes in one-to-many connections. This makes the package useful for teaching applications and for supervisory monitoring. As its pop-up menu shows, however, that's not all it can do.

The Ultimate...

Screen Capture and Print Software

You know how much time you spend in the creation of perfect graphic images. Ones that display your views, ideas, and creativity. Well, don't stop at the screen. *Pizazz Plus* will take your screen based images and print them anywhere and anyway you want, as well as create files directly compatible with any popular desktop publisher. With *Pizazz Plus,* you can capture the entire screen or isolate a section. Adjust size, proportion, rotation, or placement on the page. You will see more detail and texture in your B&W prints and desktop publishing files with up to 256 shades of gray. For color printers, your prints will come to life with a rainbow of print shades and options.

What you see is just the beginning. Since the introduction of *Pizazz* (PC World "Software Hits of 87"), it has been without question the best tool available for the reproduction of screen based graphics and/or text. The bottom line is, if it looks good on your screen, it will look good when printed or merged into your report, brochure, or presentation. *Pizazz Plus* doesn't just print images, it pushes your printer to its maximum capability to produce a masterpiece. And, it's memory resident—your image is never more than a keystroke away from professional printing or importing into your desktop publisher.

PC WORLD SOFTWARE HITS of '87



The perfect import tool for your desktop publisher.



Print in vivid color for maximum impact.

All images were produced with Pizazz Plus.

Pizazz Plus Compatible Hardware

Computers: IMB PS/2, PC, XT, AT, or compatible
Display Adapters: IBM VGA, MCGA, EGA, CGA, 8514A and others
Extended VGA Display Adapters: Video Seven FastWrite VGA and V-RAM VGA
Image Capture Boards: AT&T TARGA 16/24/32 and ICB, ATronics PIB and PIB+, Vision Technologies Vision 16 EV-680
Printers: *Pizazz Plus* supports over 300 different printer models from the following manufacturers:

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while the video graphics display is cut to 15 percent of its normal speed.

VOLUNTARY SLAVES

The programs that are found in *D-Link Screen Monitor* are TSRs, taking up 128K RAM in the master PC and 64K in the slave. If an AUTOEXEC.BAT file logs users into the network, it can also sign them into the *Screen Monitor* program. However, if an operator elects not to sign in as a slave, the master user holds no control over that PC. Rebooting the PC is the only way to unload the Slave or Master TSRs. Because the *Screen Monitor* Master program is a TSR, you can be in any other program and simply hotkey right in and out of the monitoring task.

> The programs in *D-Link Screen Monitor* are memory-resident TSRs, taking up 128K RAM in the master PC and 64K in the slave. Rebooting the PC is the only way to unload the Slave or Master TSRs.

There can be only one master station active at a time on a network—the master station is the first one that runs the Master program—but the program allows up to 254 stations to act as slaves; these can be organized into as many as four named groups for easier referencing. The limitation on the number of master stations comes from the architecture of the program and is not a licensing ploy. Buying more packages does not let you activate more master stations.

The *Screen Monitor* package includes a thin installation and user guide. Because the program is simple to install and operate, you shouldn't need much more. If you do, you can access a company bulletin board by calling (714) 549-3760.

The people at D-Link Systems promote *Screen Monitor*'s use as a teaching package, but in our opinion this use is limited due to the program's lack of a many-to-one relationship between the instructor and the students. As it is, the software allows only the teacher to play an interventionary role. If *Screen Monitor* were designed to allow more than one designated master, the students could view the instructor's screen for demonstrations and even contribute to the output.

Screen Monitor does have a feature that allows slave screens to display what's on the master's screen, but this can be done on only one slave screen at a time, and slaves cannot input to this screen. The master can broadcast messages to the slaves, however. The package's ability to allow the sharing of resources is limited—only the master can use remote resources.

If it's network monitoring and graphics transfer that you desire, and you want these features badly enough to put up with serious processing-speed reductions, *D-Link Screen Monitor* just may be the right package for you.

LAN Assist Plus

An egalitarian remote-control package, Fresh Technology Group's *LAN Assist Plus* provides a wide range of options, many of them user controlled. Due to its one-to-one, one-to-many orientation, the $199 package is best suited to providing technical support and demonstrating software on a network running under Novell's *NetWare*.

LAN Assist Plus is the only one of the packages we reviewed that uses the same program to provide both the monitored and monitoring functions. The company has decided to give neither the controlled nor the controlling station a designating term.

You start the program by typing LA at the DOS prompt. If you want another station to be able to control or monitor your PC, then you start the program with the command LA +A. The +A argument loads the 3K RAM-resident portion of the *LAN Assist* program and allows anyone to assist or monitor you.

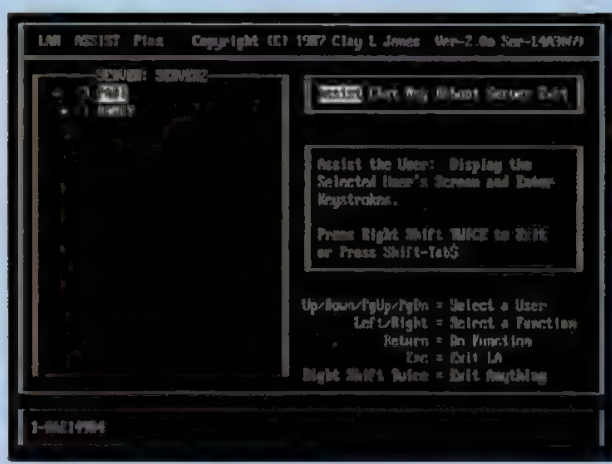
You use similar start-up commands to load the main program along with Chat Windowing; to load the monitoring program as a TSR (including the Chat fea-

FACT FILE



***LAN Assist Plus*, Version 2.0**
Fresh Technology Group, 1478 N. Tech Blvd., #101, Gilbert, AZ 85234; (602) 497-4200
List Price: $199 per file server.
Requires: 3 to 6K RAM under normal configuration (additional hotkey menu: 34K), IPX-compatible LAN, DOS 1.0 or later.
In Short: *LAN Assist* requires a small amount of memory and an even smaller amount of cash. Its stability and flexibility make this a good buy for anyone who wants to do remote user support on a Novell-based network.

CIRCLE 608 ON READER SERVICE CARD



Perhaps the most affordable package in this review, at $199 per server, *LAN Assist Plus* from Fresh Technology has a no-frills menu system that allows you to choose different host/guest relationships for each connection.

ture); or to load the resident program that allows you to assist, monitor, or remotely control another user.

When you sign in to assist or monitor another station, a professional and helpful menu greets you. In addition to a list of menu options and a small help screen that provides a synopsis of those options, the menu provides you with a list of all the users currently logged in to the server. (A program-wide option that is set when you install the program can have the program list the users currently logged in to other network servers; of course, you must log in to that server in order to connect to its assigned users.)

> Because of its one-to-one, one-to-many orientation, *LAN Assist Plus* is best suited to providing technical support and demonstrating software on a network running under *NetWare*.

SIMULTANEOUS CHATTER

Like Crosstalk Communications' *R2LAN* and Norton-Lambert's *Close-Up/LAN*, *LAN Assist* offers a Chat feature to let you communicate over the LAN. This feature—which adds an additional 3.6K to the RAM requirement—splits the screen to allow the chatters to converse simultaneously. The text displayed in the Chat window cannot be stored for later reference. A Message option condenses the chat capability into one line at the bottom of the screen so that messages don't obscure the application you have on the screen.

Other *LAN Assist* options let you set program-wide defaults. You can specify whether or not you want to allow a monitoring computer to reboot another PC and whether you want the name of the monitoring station to appear on the screen. You can decide if you want to accept keystrokes entered remotely for true remote control or just allow remote monitoring without keyboard entry. You can prevent anyone who is not logged in to the Novell network server from monitoring. All of these defaults can be overridden at the DOS prompt similarly to the way the different programs are loaded.

LAN Assist performed well in our series of performance tests. The amount of traffic generated on the LAN was small, and the program worked true to its claims: simply, effectively, and with minimal memory requirements.

DIFFERENT SETUP

The setup for *LAN Assist* is a little different from the others in that it requires you to use a *NetWare* management utility (which makes some sense, since the program runs only with *NetWare*). At the present time, the program's technical support is solely over the phone, but Fresh Technology tells us it will be providing a bulletin board number for update and other product information.

Even by including Chat and Message, *LAN Assist* does not contain the robust features of *Close-Up/LAN*. It lacks the multiple printing capabilities, CGA graphics support, and file transfer capabilities found in other programs, but at $199 per server, Fresh Technology is practically giving the program away. Time will tell if they can continue to support and market the product at this price.

LANSHARE

According to MicroNet, *LANSHARE* is a "network management utility" targeted at people involved in cooperative workgroup sharing. But even though its maker does not emphasize remote control, it does the job well. The $259.99 program handles even VGA graphics displays, which most other programs don't even attempt to support.

LANSHARE supports NetBIOS and comes with two main programs. The person doing the monitoring, or *guest*, uses the LANCALL program, which is not a TSR. The person willing to allow access (the *host*) uses LANSHARE, a TSR that takes up 12K. Both of these programs can be run at the same time, so any user can both give and receive support. One LANCALL guest can monitor up to 16 LANSHARE hosts using the program, but it does not support many-hosts-to-many-guests or many-hosts-to-one-guest configurations.

The ability to sign in as both the host and the guest makes daisy-chaining possible. In order to avoid high network overhead, MicroNet recommends keeping the daisy-chaining to a minimum, however. This good package would be even better with a hotkey allowing LANCALL to be accessed no matter what other program you're currently in. This hotkey would prevent a user from having to interrupt a current job in order to give someone else a helping hand.

FACT FILE



LANSHARE
Version 2.0
MicroNet Inc., 2356 Parkside Dr., Boise, ID 83712; (208) 384-9137.
List Price: $259.99 per LAN
Requires: 12K RAM, NetBIOS services, DOS 3.1 or later
In Short: *LANSHARE* supports a wide variety of graphics, has good security, and offers flexibility in assigning relationships. Even though it lacks a few of the bells and whistles of the competitors, this product does its job well.

CIRCLE 609 ON READER SERVICE CARD

The program allows you to determine who monitors whom. In its default mode, it gets its list of possible connections from a file called USERLIST, which is created by whoever installs the program—an easy process that basically involves creating the directory and copying files—but the program will also take user names from any other file you specify.

For example, if the accounting department wants only the people in its group to be able to access each other, the department could create a file called ACCT listing all their members' names. Anyone wanting to monitor someone in the accounting department would have to know the name of and have network access rights to the file containing the user names. These features are more of an administrative strategy than they are security measures, because you can get around them,

LAN REMOTE CONTROL: SUMMARY OF FEATURES

(Products listed in ascending price order)

	LAN Assist Plus	LANSHARE	The Network Eye	NETremote Plus	Close-Up/LAN	D-Link Screen Monitor	R2LAN
List price	$199.00	$259.99	$295.00	$350.00	$395.00	$395.00	$795.00
pricing method	Per server	Per LAN	Unlimited license	Per server	For two users	Per network installation	Per LAN
NETWORK SUPPORT							
IPX	●	○	○	●	●	●	○
NetBIOS	○	●	●	●	●	○	●
Automatic protocol selection upon installation	N/A*	N/A*	N/A*	○	●	N/A*	N/A*
GUEST/HOST SOFTWARE CHARACTERISTICS							
Terminology for guest/host	User/assisted	Caller/share	Master/workstation	Caller/listener	Viewer/host	Master/slave	Caller/host
Which partner is TSR	Assisted	Share	Either	Listener	Both	Both	Host
RAM used for TSR guest	N/A	N/A	30K	N/A	64K to 76K	40K	N/A
User can hotkey in and out of guest role	●	○	●	○	●	●	○
RAM used for TSR host	3K to 33K	12K	2K	17K	26K to 50K	75K	64K
Host TSR can be removed without rebooting	●	○	○	○	●	○	●
Extra RAM used for chat	3.6K	N/A	N/A	N/A	0K	N/A	6K
CONFIGURATION OPTIONS							
Simultaneous multiple sessions	●	●	●	●	●	○	○
Number of connections:							
Host-to-guest	1	1	32	1	16	1	1
Guest-to-host	Unlimited	16	99	1	16	16	1
Log-in as both guest and host (to provide many-to-many connections)	●	●	●	○	●	○	●
Host can initiate connection	● (using chat)	○	○	○	●	○	● (using chat)
Program allows exclusive connection	●	●	●	●	●	●	●
Host is notified of connection	User option	User option	User option	●	User option	●	●
Host is allowed to reject connection	User option	●	○	○	●	○	●
Host is allowed to terminate connection	User option	●	○	●	●	○	○
Host's keyboard can be disabled	●	●	○	●	●	●	●
SCREEN TRANSFER FEATURES							
Program sends only screen changes	○	○	○	●	●	●	●
Program sends screen updates on timed basis	●	●	●	●	●	○	○
User can control frequency of screen updates	○	○	●	○	●	○	○
Remote graphics supported	○	CGA, EGA, and VGA	○	CGA	CGA	CGA, EGA, and VGA	CGA
Dialog/chat feature	●	○	○	○	●	○	●
MISCELLANEOUS							
Passwords for host	User option	●	●	User option	User option	○	User option
Remote reboot of host	User option	○	●	●	●	○	●
Guest/host can daisy-chain	○	●	●	●	●	○	○
File transfers supported	○	○	○	○	○	○	●

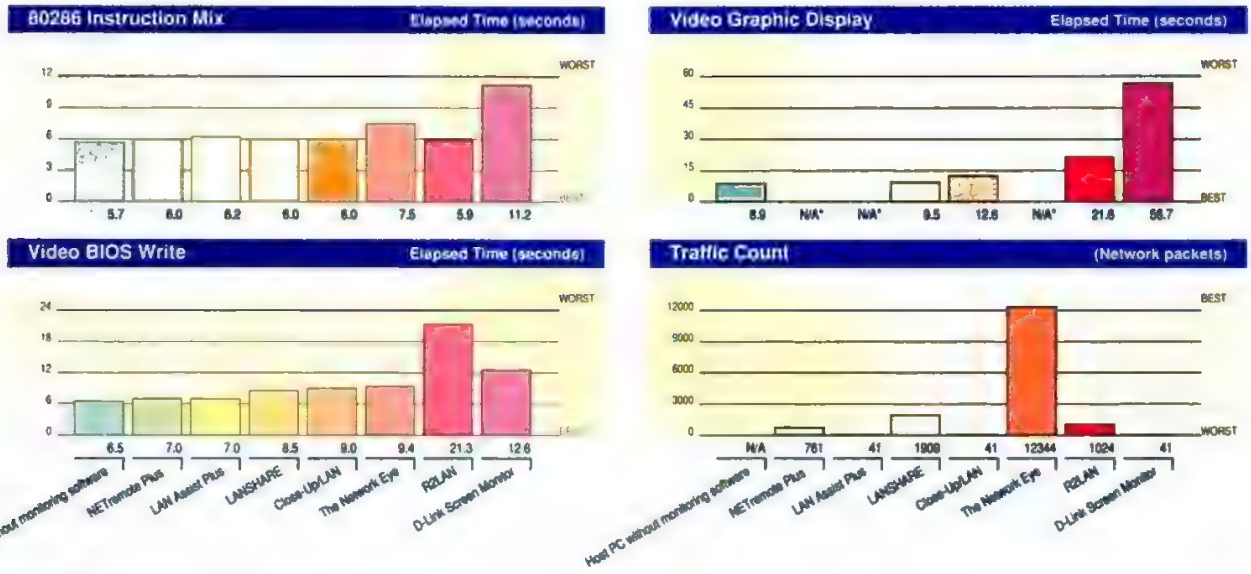
PC—Editor's Choice ● —Yes ○ —No

N/A* —Not applicable: the product supports only one protocol.

N/A —Not applicable: the product does not have this feature.

PERFORMANCE TESTS: LAN REMOTE CONTROL

NETremote Plus and _LAN Assist Plus_ move linked screens quickly, as their Video BIOS Write test performance shows. The 80286 Instruction Mix performance of _D-Link Screen Monitor_ and _The Network Eye_ indicates that they sap processing power from the monitored PC.



N/A*—Not applicable: this product does not support CGA graphics.
N/A —Not applicable: the host PC was not generating network packets.

The standard PC Labs **80286 Instruction Mix** test runs on the host PC with the host software not loaded (for the entry labeled "Host PC without monitoring software") and loaded (for the other entries). The host TSR steals processing time from foreground applications. The results show how much a monitored PC's foreground program performance degrades.

The **Video BIOS Write** test writes scrolling text to video memory using BIOS calls. The test reports the time needed to scroll 8,000 characters on the monitored PC and send them to the screen of the monitoring PC.

The **Video Graphic Display** test sets the monitored machine's video to graphics mode 6 and then performs the same scrolling action used in the Video BIOS Write test. This activity tests the software's ability to handle the CGA graphics mode.

The **Traffic Count** test changes one character on the monitored PC's screen each second for 30 seconds. The test counts how many network packets the monitored machine generates to send its screen images and updates to the monitoring machine.

The **Bell Test** generates the ASCII bell character (07h) ten times. A bell symbol indicates that the software has the ability to transmit across the network a character not found in the PC video set.

Bell Test	
Host PC without monitoring software	
NETremote Plus	—
LAN Assist Plus	—
LANSHARE	—
Close-Up/LAN	—
The Network Eye	
R2LAN	
D-Link Screen Monitor	—

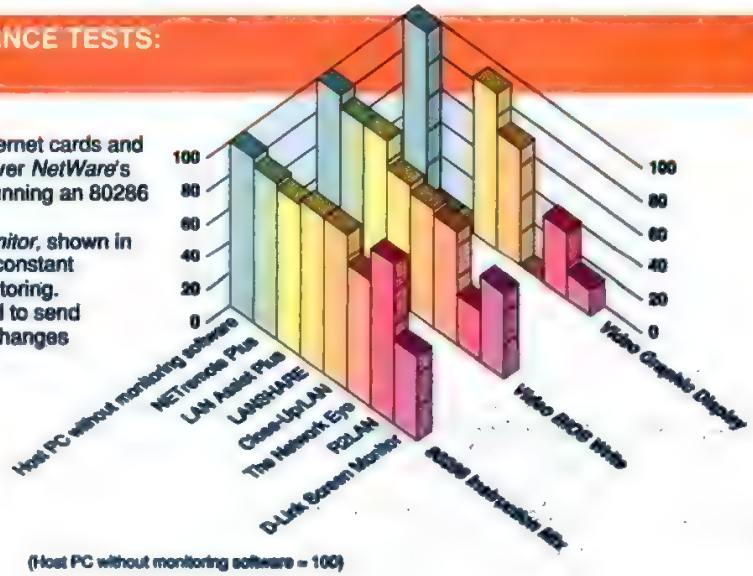
LAN REMOTE CONTROL PERFORMANCE TESTS: COMPOSITE VIEW

We tested these products on a LAN using Gateway G/Ethernet cards and Novell's *NetWare;* products requiring NetBIOS were run over *NetWare*'s NetBIOS emulator. The host PC was a Dell System 200 running an 80286 processor at 12.5 MHz.

The slow processor performance of *D-Link Screen Monitor,* shown in the 80286 Instruction Mix column, comes in part from the constant interrupts the program generates to notify the user of monitoring.

The Traffic Count test results mirror the strategies used to send video screens. The three products that send only screen changes are immediately identifiable by their low counts. *The Network Eye,* on the other hand, transmits the whole screen buffer regardless of changes.

Users of *Close-Up/LAN* and *The Network Eye* can change time slicing and screen update cycles to tailor performance; these results are based on the default settings.



(Host PC without monitoring software = 100)



What better way to run Novell's 386 NetWare.

Novell's new 386 NetWare® will do for networking what gunpowder did for negotiating leverage. Provided you've got a 386 machine that's designed to be 100 percent compatible with it.

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Samsung's LAN hardware was co-designed by Novell.® Which should put any compatibility concerns to rest. That's why the Samsung/Novell co-label is on our 386AE Fileserver and our PCterminal/286 LAN workstation.



NETWORKING vs. NOTWORKING.

Both the Samsung 386AE and PCterminal/286 have been tested exhaustively by Novell for compatibility with popular networking hardware and NetWare products. In fact, no other LAN hardware has ever undergone such extensive testing.

But then Samsung and Novell didn't set out to design just another make-do desktop computer.

Samsung's 386AE Fileserver, for example, was designed from the bus up to be a high-performance fileserver, starting with its Novell-developed BIOS. It also sports eight expansion slots for the inevitable inventory of interface and controller cards. Plus an oversize power supply capable of driving the requisite 100 megabyte-plus hard disk, tape backup system, etc. And it includes 4 megabytes of high-speed RAM for disk caching.

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To maintain NetWare compatibility throughout

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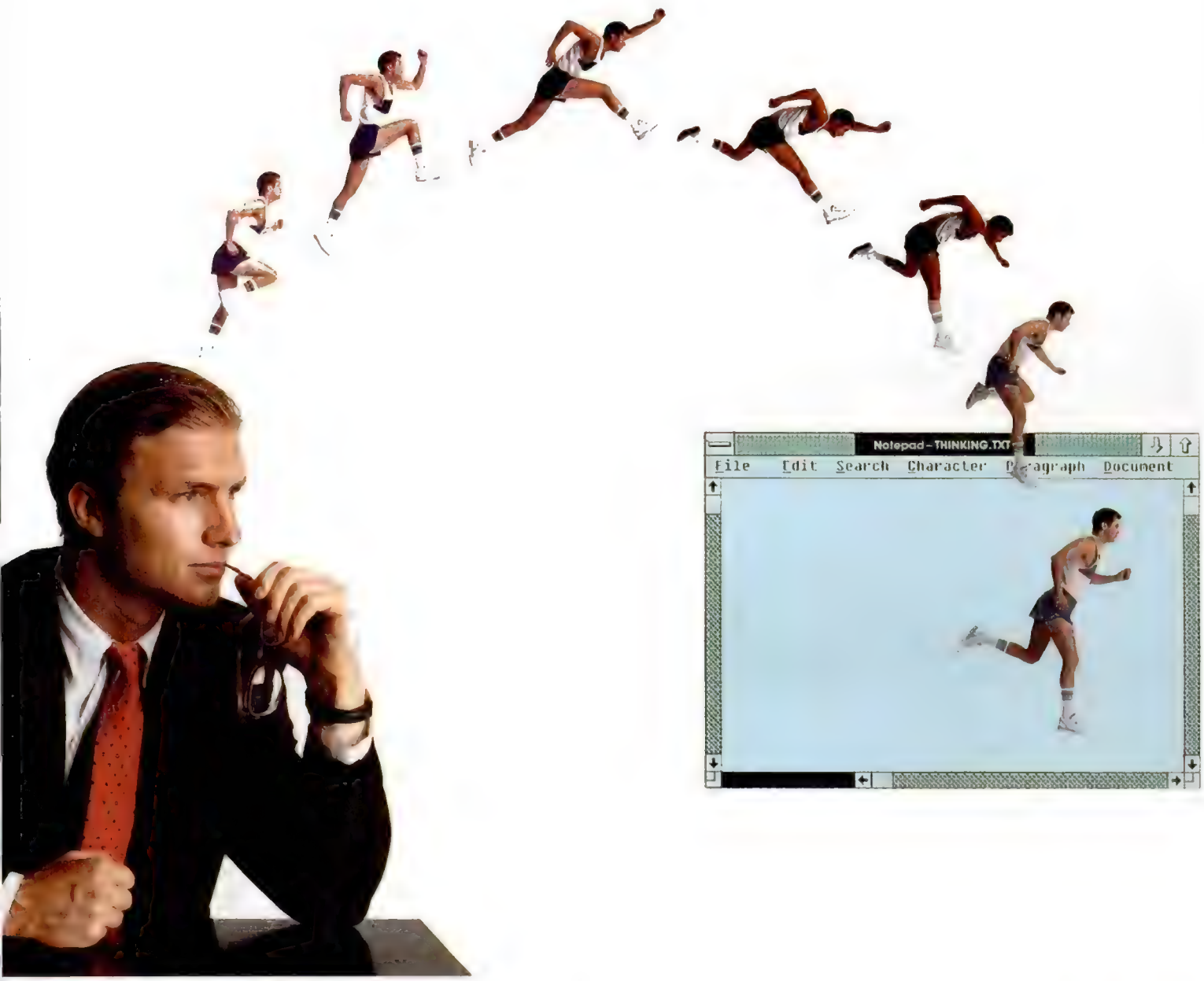
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but they certainly do discourage casual monitoring by people outside of specifically designated groups.

ASSURING SECURITY

However, *LANSHARE* has other, more-stringent security features. The program has provisions for protecting monitored PCs through the use of case-sensitive passwords. You must know someone's password to share his or her terminal. The supervisor can set a master password as a safeguard against employees with short memories.

LANSHARE's host menu gives the users being monitored a number of options. When someone running the LANCALL program tries to contact a host, a message appears on the host's screen providing the option to refuse the connection. The amount of time this prompt stays on the screen is determined during the installation process. If you don't react fast enough or are not at your desk, the connection will not go through.

The host menu also lets hosts determine what callers can do. Callers may be able only to monitor host actions, or they may also be able to input keystrokes. Another good feature, from the host's point of view, is the power to end the session quickly. (The TSR software does not automatically unload when you terminate a connection. You must manually reboot to unload the host TSR.)

GRAPHICS SUPPORT

LANSHARE supports a wide variety of graphics displays, including CGA, EGA, and VGA. It is the only product besides *D-Link Screen Monitor* to support the VGA standard. But since the VGA display contains a lot of data, we weren't surprised to see a jumpy presentation on the monitoring screen in that mode. Moving dense graphics screens from one PC to another in near real time is a tough technical problem that several of *LANSHARE*'s competitors are still struggling to solve.

Even though MicroNet doesn't emphasize remote control, *LANSHARE* does the job well. The program handles even VGA graphics displays, which most others don't even attempt to support.

Free technical support is available for *LANSHARE* users; the slim manual MicroNet provides offers complete assistance for installation and operation of the program. The company has an IPX version in the works, but it wasn't ready for our review.



The *LANSHARE* package is actually two programs: LANSHARE for allowing access and LANCALL for monitoring others. The LANSHARE setup screen, shown here, allows a user to define the connection very precisely. MicroNet asks $259.99 for an unlimited license.

In addition to monitoring (which it doesn't stress as an application for *LANSHARE*), MicroNet envisions a new application—group authoring—for its product. However, the package doesn't include a chat feature that would make group authoring practical.

The connection flexibility of *LANSHARE*, its ability to exchange high-density graphics, its relatively low price, and its security features are all laudable. However, its failure to support many-hosts-to-one-guest and many-to-many connections limits its appeal.

NETremote Plus

It's easy to be misled by the name of Brightwork Development's LAN remote monitoring and control product. Although it may sound as though the *NETremote Plus* program connects only to a remote network, the $350 program really does much more, though its focus is solely on one-to-one communications.

NETremote Plus supports both NetBIOS and IPX. The program is ideal for helping a user on a remote LAN via a modem, for sharing resources on a network, and for allowing trainers to provide technical assistance across the network. Though the relationship in *NETremote* is always one-to-one, there can be multiple one-on-one sessions occurring simultaneously on the same network.

When you sign in as a *caller* to monitor a *listener*, you see a clean and simple menu screen. The designers of *NETremote Plus* made it easy to initiate a connection by providing a display of the names of the people logged on to the current server who are running the Listener TSR. You simply highlight the name and hit Enter to establish a link to one of them.

A two-line help menu on the bottom of the screen tells you if any errors occurred during calling and in addition, provides an assessment of these errors. The help menu also displays the options for selecting another server and exiting the program. This Caller program is easy to use and also provides you with good feedback on both the progress and status of any connection, but it is not a TSR.

The Listener program that comes with *NETremote Plus*, on the other hand, is a TSR. It occupies from 17K to 29K in RAM, depending on the type of network

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software and video display you use. A tune is played on the speaker of the monitored computer, which alerts the listener that a connection has been made. When the connection terminates, the tune plays backwards. Once the call goes through successfully, the caller's program gives full and direct access to both the screen and the keyboard of the listener.

The amount of control the caller has can be determined by the parameters added to the NRLISTEN program used by the listener. The listener can, for example, force the caller to use a password. He or she can also disable the caller's keyboard, allow or disallow new calls, let the caller reboot the system, and even terminate the connection to the caller. There are also parameters to change the performance mode, to display the status and help screens on the listener's end, and to designate whether to support the transfer of CGA-mode graphics screens or to save memory by not supporting graphics.

NETremote Plus is ideal for helping a user on a remote LAN via a modem, for sharing resources on a network, and for allowing trainers to provide technical assistance across the network.

These command-line parameters work, and they're useful when you start the program in a batch file, but providing a menu with the options for NRListen would enhance the program. Since Brightwork Development is charging $350 for the program, it should be able to save users from hunting through the manual in search of available options. The program does offer a HELP parameter that displays some information about the options, but it is not the same as a menu.

EFFICIENT PERFORMANCE

NETremote performed well on our tests. It doesn't slow down the functioning of the host machine much at all, and the various performance options available under the program allow you to balance the speed of the screen changes on the monitored PC with the need for screen updates on the monitoring machine. Additionally, the *NETremote Plus* program sends packets across the network only when the screen changes. This helps to reduce the traffic on the network.

This product requires the use of an INSTALL.BAT file that leads you through the installation process and setup of the software. The installation program doesn't have the built-in ability to examine the network and load the correct network protocol driver for you, as *Close-Up/LAN* does. A

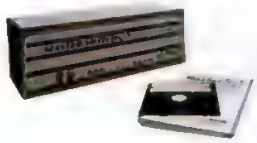


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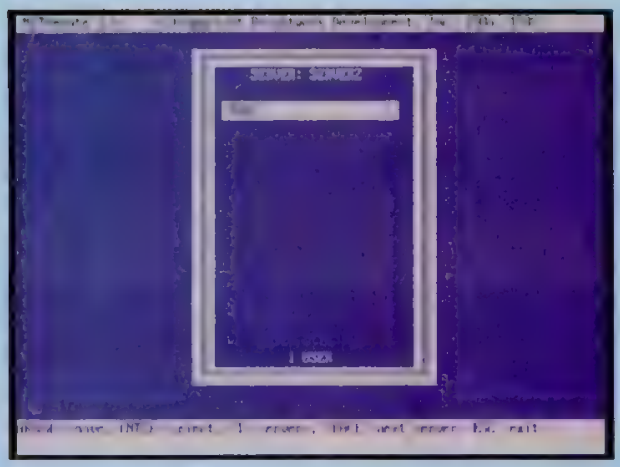
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CIRCLE 290 ON READER SERVICE CARD



Brightwork Development's *NETremote Plus* works equally well with both major network protocols. The $350 (per server) product has a convenient point-and-shoot directory, shown here, that handles one-to-one remote control.

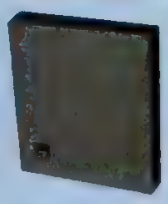
tutorial included in the manual reads short and sweet. If a user should require further help, he can call the technical support line maintained by Brightwork Development.

In addition to the LAN remote-control product we reviewed here, the *NETremote Plus* package also contains an asynchronous communications/modem remote product, which is called *CO/Session*. We did not review this part of the package.

Version 4.0 of *NETremote Plus* should be available by the time this review hits the newsstands. This release promises EGA graphics support as well as a reduction in both network traffic load and memory requirements. The new version should also give listeners the ability to reject an incoming call.

NETremote Plus is a good product, but we feel it could be improved upon by providing a way for the Caller program to be loaded as a TSR. Nonetheless, its speed and wealth of options make it worthy of consideration as an impressive contender in the one-on-one arena. It is a good choice if you want to run programs remotely on underutilized PCs or share other resources over the LAN.

FACT FILE



***NETremote Plus,* Version 3.0**
Brightwork Development Inc., P.O. Box 8728, Red Bank, NJ 07701; (800) 552-9876, (201) 530-0440
List Price: Single server, $350; four-server network, $695; LAN Support Center option, $495.
Requires: 31K RAM, NetBIOS- or IPX-compatible LAN, DOS 3.0 or later. (Single server works on Novell only.)
In Short: A good basic remote-control and support program providing one- to-one relationships, with multiple sessions available. IPX support makes this a good candidate for *NetWare* installations.

CIRCLE 610 ON READER SERVICE CARD

The Network Eye

Its name is evocative of an old TV detective series, and just like a classic private eye, this package is a little offbeat but will go anywhere and do anything to get the job done. Artisoft's $295 package, *The Network Eye*, which runs under NetBIOS, separates itself from the other remote control programs beginning the moment you start to use it.

The other monitoring/support programs reviewed in this issue follow one general pattern of operation: Once you start to monitor or control another personal computer, your screen produces an exact replica of that computer's display. *The Network Eye* is the only program to use a multiple-window design. This unique design allows you to view and control up to 32 monitors concurrently.

Each of *The Network Eye*'s windows—all of which can be shrunk to display but a single line or expanded to fill the entire screen—displays a portion of the monitored screen around the command-line prompt. As a result, this scheme doesn't work with all applications, but in many classroom, management-monitoring, and system-support applications, multiple on-screen monitoring can be valuable. Additionally, these windows have contrasting colored borders on a color monitor.

The Network Eye allows you to act as both a monitored and monitoring station—you can even do both simultaneously. Though the manual does not over emphasize the potential of this feature, we feel it greatly enhances *TNE*'s place in the market. Multiple relationships provide more flexibility for both support and resource-sharing activities on the network. Up to 32 workstations can monitor the same PC at the same time—ideal for teaching applications.

The Network Eye allows you to act as both a monitored and monitoring station—you can even do both simultaneously. Up to 32 PCs can monitor the same PC concurrently—ideal for teaching.

TNE incorporates the one-to-one, one-to-many, and many-to-one relationships. The monitoring stations are called *masters* and the monitored PCs are called *workstations*. Both masters and workstations can be set up as TSRs, so you can quickly jump in and out of monitoring roles without changing applications. The Master program module uses 30K of RAM, and the Workstation TSR takes a tiny 1- to 6K, depending on the configuration of the network.

As a monitored workstation, you sign into the program right at the DOS prompt, stating any special parameters you'd like assigned to your station at this time. You

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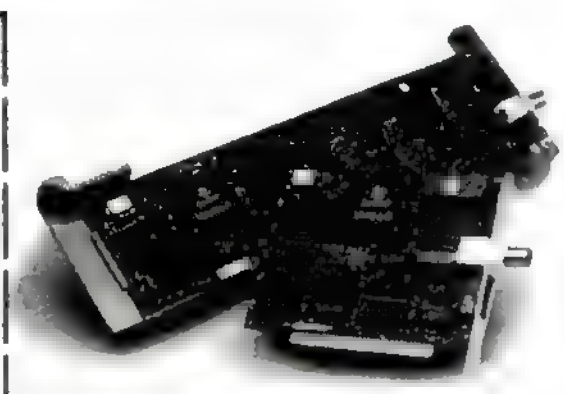
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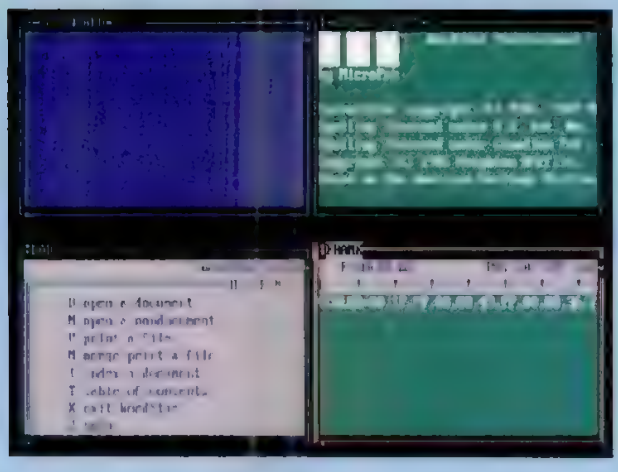
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CIRCLE 124 ON READER SERVICE CARD



The Network Eye, $295 from Artisoft, runs under NetBIOS. Its unique multiple-window design allows you to view and control up to 32 monitors simultaneously. Each window displays the command-line area of a monitored screen.

can, for example, name your station, determine how many masters can control and monitor you at the same time (one master is the default), and make sure that you receive notification whenever you are being watched by a master.

On a workstation, you can also set any passwords a master must know in order to use your system. If you want, you are given the option to implement a two-level security system: a first password to restrict monitoring and a second to restrict control of your PC. If you do not type any passwords when you sign in, then anyone signing in as master can gain access and, as a result, control your machine. You must reboot your system to log out of *TNE* as a workstation.

On the workstation end of a connection, your keystrokes progress at normal speed and your work goes on as usual. The *TNE* TSR slows you down, but not appreciably. According to our performance tests, the program slowed down processing and video speed by approximately 20 to 30 percent.

ADJUSTABLE INTERVALS

The degree to which the PCs running *TNE* are slowed down can be controlled somewhat by the users of the program. The program is designed to transmit a total screen to the monitoring station(s) at set time intervals; you can change the values of those intervals to optimize them to your configuration. This capability is important, because the program doesn't discriminate between screen elements that have changed and those that have not. This means that if you have a lot of active *TNE* stations, a significant load on the transmission capability of some network-cabling schemes results. On some networks, you might want to increase the monitoring interval in order to decrease the data load.

When you sign in as the master, you had better have your manual close at hand. You control the program with Alt-key commands, and the command names and symbols you will need to know aren't all intuitive. Additionally, the only error messages you are going to receive are beeps. Once you have become familiar with the program, it proves both versatile and reliable, but it does take a while to learn. A toggle help menu would be desirable.

The master program initially displays two windows with contrasting colored borders. The first window, called the Clipboard, stores cut-and-pasted text between workstations. The second window, called the Local Screen, displays the contents of your master terminal's screen. The windows have cursor control points for sizing and moving the screen, but you don't need a mouse to use them. You can type in the name of whatever workstation you want to access, but there is no list of active stations to prompt you.

When the connection is made, the window on the master's screen reveals the contents of the workstation's screen. A zoom function allows you to view the entire screen. If you link to more than one workstation at a time, an option lets you scroll through each one's full-size screens. You can also start an automatic rotation through the named screens, which changes the viewed screen every 5 seconds. As you move between windows, the program appears to make the current highlighted window come to the front of the screen while stacking the rest of the screens behind the active one.

> You can set any passwords a master must know to use your system. You can also implement a two-level security system; first, to control monitoring; second, to control use of your PC.

In place of a file transfer feature such as the one in *R2LAN* there are commands to let you cut-and-paste full screens from one workstation window to another. The program stores the text in the Clipboard window between moves. You cannot paste into the local screen, because its processing is suspended. This works well for transferring formatted text, but the screens of some spreadsheets and other programs won't work with the cut-and-paste feature, because their lines don't end in hard carriage returns.

FACT FILE



The Network Eye,
Version 1.23
Artisoft Inc., Artisoft Plaza, 575 E. River Rd., Tucson, AZ 85704; (602) 293-6363.
List Price: $295.
Requires: Workstation: 2K RAM; Master: 30K RAM; NetBIOS services; DOS 3.1 or later
In Short: *The Network Eye* combines many interesting and some unique features in a low-priced package. Using pop-up windows and running with NetBIOS, *TNE* allows significant flexibility in training and support relationships

CIRCLE 612 ON READER SERVICE CARD

The installation of *TNE* involves creating a directory and copying files from the floppy disk that comes with the package. Since the *TNE* program runs under NetBIOS, you must have NetBIOS services available before going into the program, or else an error message on the prompt line will remind you of your oversight. The need for NetBIOS means that if you use the *TNE* program on a Novell network, every monitored and monitoring station loses another 20K of RAM to the NetBIOS emulator.

After you purchase the program, you can send in your registration card and receive 30 days of free support. The software package includes a user manual, complete with descriptions of error messages. You can call Artisoft's electronic bulletin board at (602) 293-0065.

The ability to simultaneously use *TNE* as both master and workstation impressed us, as did its ability to allow users to control the frequency of screen updates. A few suggestions we have for future revisions include giving a workstation the ability to refuse and terminate a connection, providing a toggle menu screen for the master program, and providing more-complete help menus. *The Network Eye* does not support CGA graphics at this time, nor does it support Novell's IPX protocol. Although these features would be welcome, their absence doesn't detract from the unique interface and features in this program.

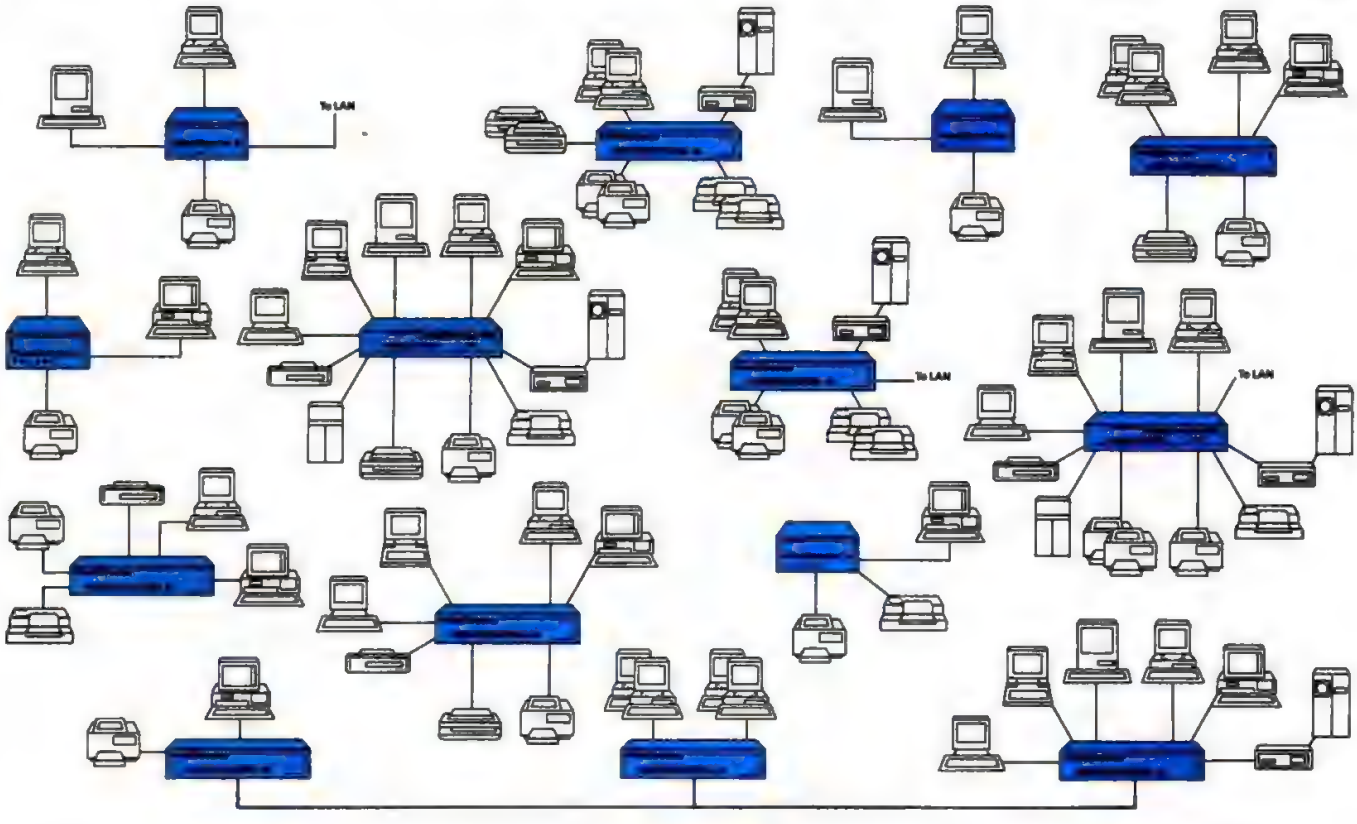
Send in your *TNE* registration card and receive 30 days of free support. A user manual with descriptions of error messages comes with the software.

R2LAN

A close kin to Crosstalk Communication's *Remote 2* program for modems, *R2LAN* connects two stations across a LAN rather than across telephone wires. The acknowledgable fortes of this package, which sells for $795 for a one-LAN version and features a unique file transfer capability, are remote control of resources and providing technical support, because it is capable of establishing only a one-to-one relationship between users.

One of the selling points of *R2LAN* is its ability to appoint appropriate users as systems managers who can then set up users and defaults. The package lets you create up to 3,000 systems managers and/or users during the installation process. A systems manager can also keep a log of incoming calls in an ASCII file for future reference, allowing him to track who uses the program and how they use it. The version of *R2LAN* we received for review ran only over NetBIOS, though the company promises an IPX version will be ready for shipment soon.

More solutions for printer sharing



In the *Remote 2* program, the station doing the monitoring is called the caller, while the station being monitored is the host. The host TSR software requires 50K of RAM on a computer equipped with a monochrome screen or 72K RAM on a CGA system. Callers are allowed to connect only to hosts, and vice versa, but the program does allow multiple sessions to occur simultaneously.

The *R2LAN* Caller software includes a complete and easy-to-use menu system. This menu, which is activated by a hotkey, employs the simple point-and-shoot method to call into a host's system. A message pops up at the center of the screen, informing you about the progress of the connection, telling you when you've connected, and asking for a password if the host requires one. In addition the menu also provides you with a complete list of commands and options.



Crosstalk Communications' *R2LAN* has a user-friendly dialing directory, shown here, that makes connections through menus. *R2LAN* costs $795 for a one-LAN installation and is the only program in this review to offer file transfer without using a file server.

R2LAN's hotkeyed menu system employs a point-and-shoot method to call into a host's system.

One interesting option on the caller's menu lets the connected stations exchange files—a feature unique to *R2LAN* of the packages reviewed. *R2LAN*'s file transfer capability lets networked stations transfer files easily, without using or even establishing a traditional file server. The program also gives you the ability to list and

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sort directories to make the file transfer task easier. This function is particularly valuable when used over the long-distance telephone LAN-to-LAN links available through the combination of *R2LAN* and *Remote 2*.

Once you've signed into your station as a potential *R2LAN* host, you have to simply sit back and wait to be called. There is no way to request help from a caller as is provided for in some of the other programs. In order to be able to reject a caller, a host must have a password set up for itself. There is no provision for a "Do Not Disturb" sign.

Once the caller and host connect, notification of the connection appears on the host terminal and the caller sees the exact replica of the host's screen, but the connection isn't quite seamless. The connection slows down the response of the host's terminal noticeably. In fact, our performance tests show that, while its processor speed isn't greatly affected, a PC running the *R2LAN* host software is able to perform video routines at less than half its usual speed.

To reject a caller, an *R2LAN* host must have a password for itself. There is not provision for a "Do Not Disturb" sign.

CHAT FEATURE

The Chat feature of *R2LAN* is actually a separate program that works with the Caller and host modules or alone. This simple-to-use program requires 6K of RAM on a monochrome screen and 18K of RAM on a CGA screen. The feature splits the screen in two and provides several key sequences to make your chat more eye-catching. Both callers and hosts can initiate chat sessions. Chat can be used while in an application or from the DOS prompt, though the *R2LAN* manual recommends not running Chat on top of another TSR program. Chat is simple to use and increases the total





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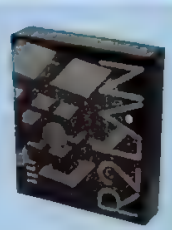
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worth of *R2LAN*.

As with Norton-Lambert's *Close-Up/LAN*, *R2LAN* allows for printing at the remote printer of the host or caller. The limitations of its one-to-one relationship hinder *R2LAN* from printing at multiple locations simultaneously.

Crosstalk Communications is a strong company with a long history in the business; it has a large technical support staff. Support for *R2LAN* includes two user manuals and a free support line. The program is easy to use, but the manuals refer to the use of the *Remote 2* family so often, you begin to wonder what package you bought.

The family relationship is a big part of *R2LAN*'s strength. DCA (the parent organization of Crosstalk Communications) and Microsoft recently announced the development of an asynchronous communications server (ACS) for networks. This combination means that you can use DCA's products to control a station on the same LAN, to control a network station from a PC in a remote location by using *Remote 2* and *R2LAN*, and to control a PC on a remote network from your local network by working through *R2LAN*, *Remote 2*, and the ACS.

The *R2LAN* package provides good programs for monitoring and assisting another user on the network. It lacks some features available in competing high-end programs, but it is well supported and should evolve quickly. By combining *R2LAN* with the *Remote 2* side of the family, you can create solutions for offices needing one-to-one support and monitoring on even a nationwide basis. ■

R2LAN's family relationship to Crosstalk's parent company DCA means that you can also use DCA's products to control a station on the same LAN and to control a PC on a remote network.

EDITOR'S CHOICE

PC MAGAZINE

• Close-Up/LAN

Providing every possible monitored-to-monitoring configuration of LAN-based remote control as well as literally every possible feature, except for a file transfer capability, Norton-Lambert's *Close-Up/LAN* is obviously a well-designed product.

Though *Close-Up/LAN*'s per-user pricing makes it comparatively expensive, but considering what you get for your money we feel it's realistic. The product is easy to install—conveniently it automatically selects either the IPX or NetBIOS protocol upon log-in. It's also especially easy to use, because it provides TSR software for both the users doing the monitoring *and* the ones being monitored, allowing both to carry out remote control and monitoring activities without disrupting their work flow. These TSRs admittedly take up a moderate chunk of RAM, but they offer more than their peers, because they provide the ability to let users "chat." Finally, all of the features that *Close-Up/LAN* offers don't bog it down much at all, even when it's transmitting graphics images between stations, an option that more than half of these packages don't even offer to the user.

Close-Up/LAN's closest competitors made picking it a tough decision, though in the final analysis, their failure to support graphics did them in. *The Network Eye* has a unique style and a wide selection of admirable features. *LAN Assist Plus* performed especially well in our tests and offers impressive ease of use as well as a flexible array of options.

Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine. *Patricia A. McGovern is a partner in a desktop publishing service firm. Pamela Watson is a professional free-lance writer and a frequent consultant to PC LAN Labs.*

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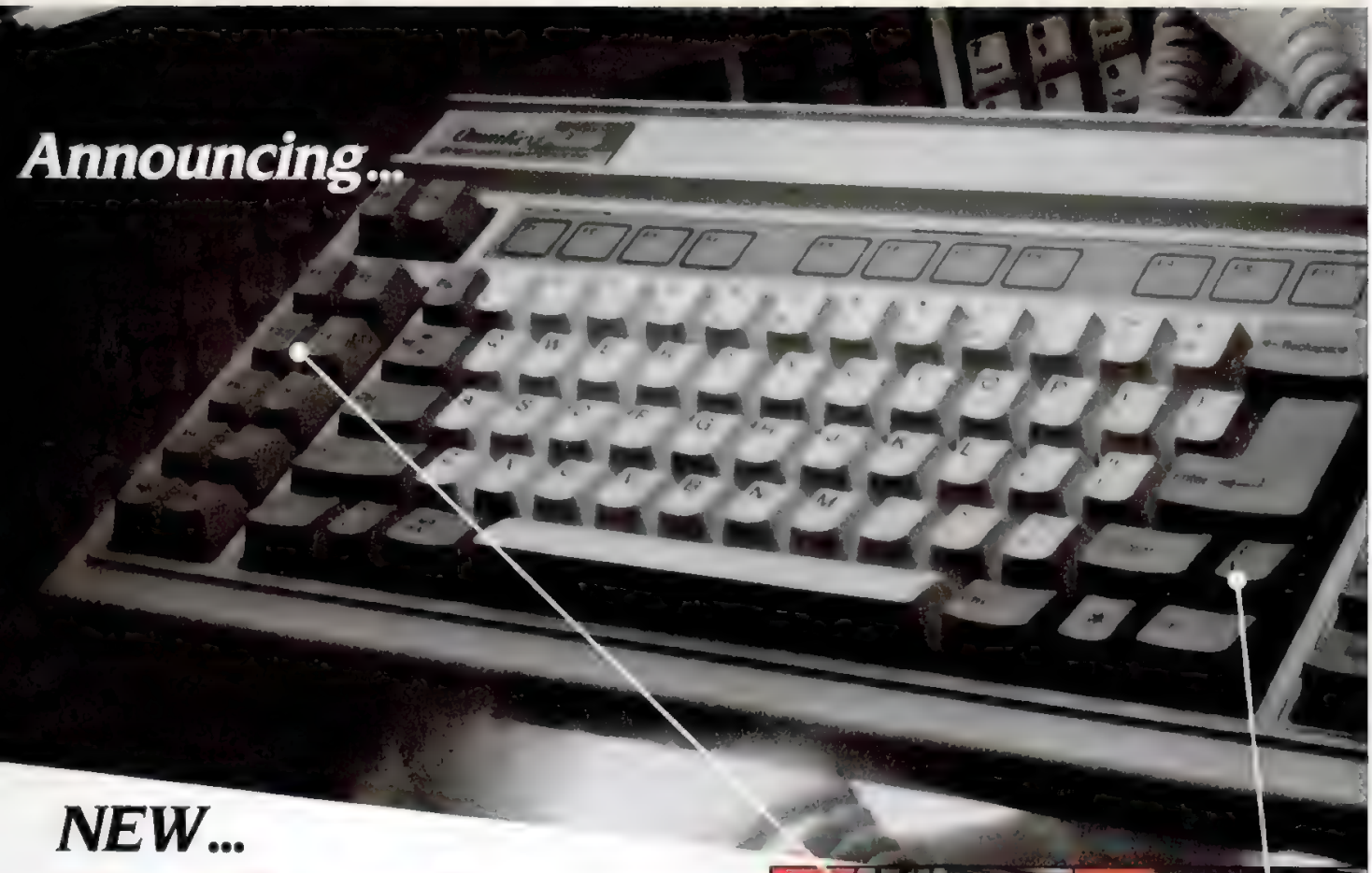
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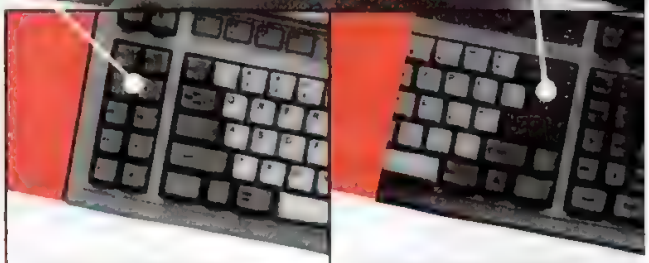
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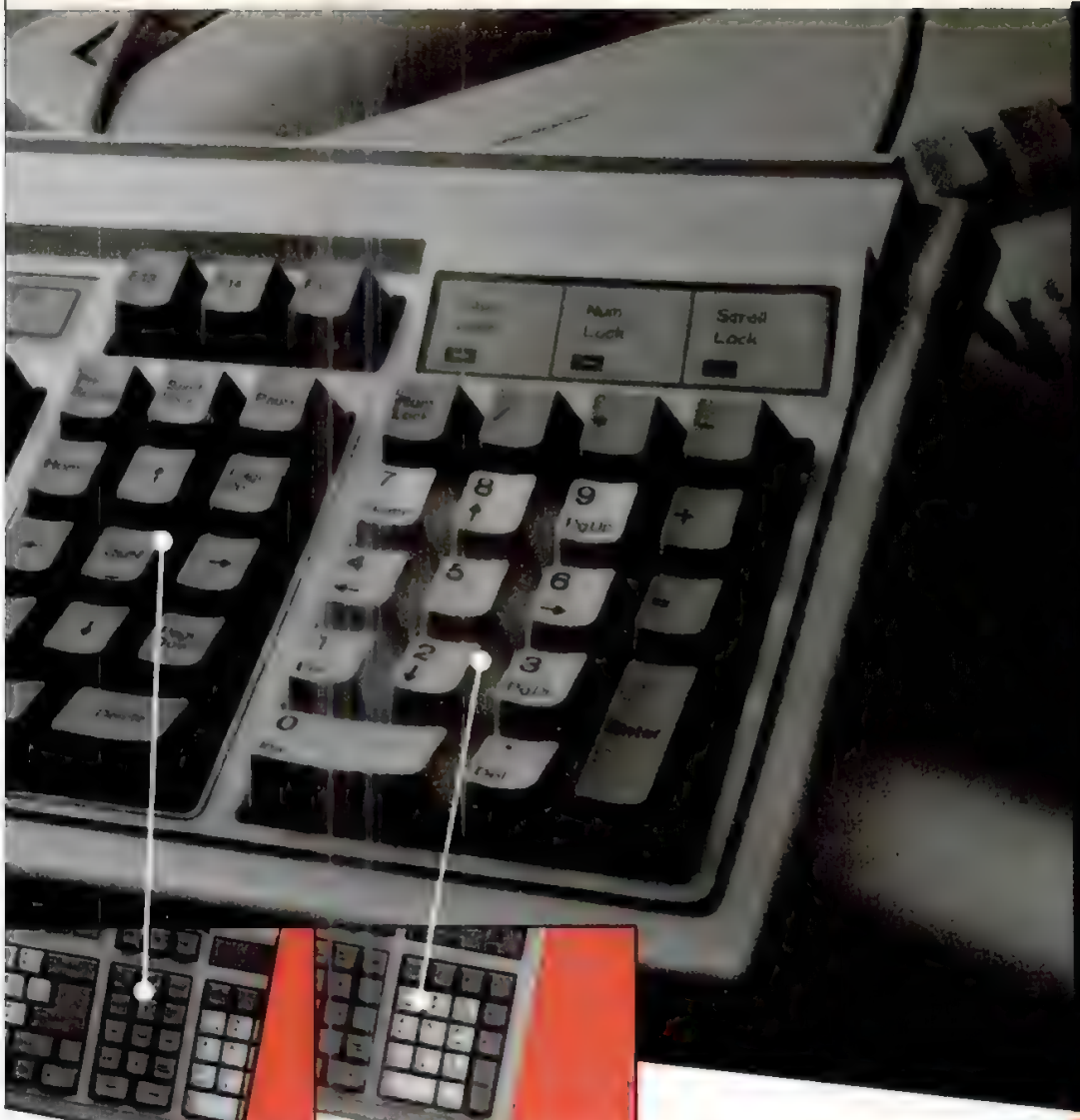
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Card No. _____ Expires _____

Signature of Cardholder _____

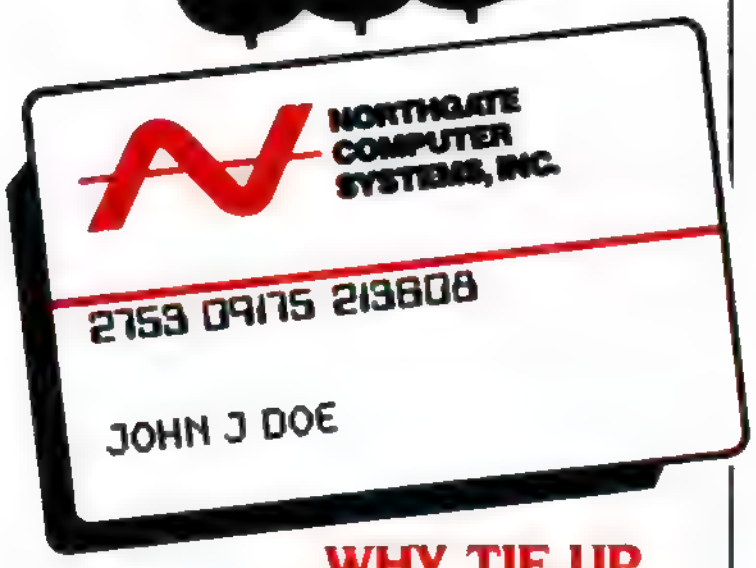
(My signature authorizes a charge to my account for the above merchandise prior to shipping to initiate processing of my order.) PCM103189

Now Northgate gives you

Credit and No Payments Until 1990**

(Payments begin 90 days from the date your Northgate Computer System is delivered to you.)

Payments as low as $40/month*



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Simply fill out the "Big N" application, and send it in. Prompt approval assured!

Once you're approved, simply call our TOLL FREE number and one of our expert system consultants can help you design the Northgate System which will best suit your needs, and it will be shipped to you right away.

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BIG N REQUEST FOR CREDIT

NOTICE TO WISCONSIN APPLICANTS
You must disclose your marital status.
☐ married
☐ unmarried
☐ legally separated

A married person may apply for indivdual credit. I am applying for (please check appropriate box):
☐ **JOINT CREDIT** with another person. Complete entire application.
☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
☐ **INDIVIDUAL CREDIT.** Complete sections "a" and "b" only.

Please complete all appropriate sections, providing at least two year's residence and employment history. This will enable your application to be processed as quickly as possible. If you are self-employed, please be sure to complete section "D" on back.

a. Your Personal Information

Requested Line of Credit $_____

Your Name: First / Initial / Last — Date of Birth: Mo. Day Yr. — Social Security Number:

Present Address: Street / Apt. # / City / State / Zip — Home Phone ( ) –

Date of Residence: Month / Year — Monthly Payment: $ — Buy ☐ Rent ☐ Other ☐

Previous Address: — Dates of Residence: From To

Your Employer: (If self-employed, see rear panel.) — Date of Employment: Mo. Yr. — Position: — Monthly Income: Gross $ Net $

Employer's Address: Street / City / State — Business Phone: ( ) –

Previous Employer: — Address: — Dates of Employment: From To

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation

Other Income: _____

I have received since: (Date) — Monthly Income: Gross $ Net $

Name and Address of Nearest Relative Not Living With You — Relationship

b. Credit Information

Include joint applicant's information, if joint account requested.

	Bank Name	Address		
Bank Account:			☐ Checking ☐ Savings	
Bank Account:			☐ Checking ☐ Savings	
Bank Loan Reference:			Payment	Balance
Bank Card Reference: ☐ VISA ☐ Mastercard				
Other Credit Card Reference				
Other Credit References:	Account No.	Expires:		

Driver's License No. — State. — Expires.

c. Joint Applicant's Personal Information

*If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract.

Joint Applicant's Name: First / Initial / Last — Date of Birth: Mo. Day Yr. — Social Security Number:

Address: Street / Apt. # / City / State / Zip — Date of Residence: Mo. Yr. — Home Phone ( ) –

Employer: — Date of Employment: Mo. Yr. — Position: — Monthly Income: Gross $ Net $

Employer's Address: Street / City / State — Business Phone: ( ) –

d. Self-Employed Information

Complete this section only if you are self employed

Business Name — Proprietorship / Corporation / Partnership

Business Address — Business Telephone ( ) –

Description of Business — Your Position — In Business Since

Your annual income from business — Business' annual income (gross) (net)

You must provide at least one of the following:

1. Business Bank Name — Telephone ( ) – — Personal Banker's Name
2. Accountant's Name — Telephone ( ) –
3. Financial statement on business attached.

PCM-1031

Complete this application and mail to Northgate today!

NORTHGATE COMPUTER SYSTEMS, INC.
13895 Industrial Park Boulevard, Suite 110, Plymouth, Minnesota 55441

**Interest will accrue during deferred period 1.5% per month, 18% APR

*Based on purchase price of $1299.00 on the "Big N" revolving charge. Prices subject to change without notice. Offer not valid for APO or FPO customers.

Ventura to the MAX

Even if you're familiar with Ventura Publisher, in some ways you still may be cruising the slow lane of desktop publishing. These 17 tips can shift you into high gear when you want to configure memory, import files, and produce professional-quality output.



by Tami Peterson

No longer is Xerox's *Ventura Publisher* the particular tool of designers, typesetters, and publishing professionals alone. The desktop publishing program ranks number one in the United States PC marketplace, with a broad spectrum of users, ranging from administrative typists up to top executives. InfoCorp, a California-based market research firm, estimates that 106,000 copies of *Ventura* shipped in 1988, outselling Aldus Corp.'s *PageMaker* by a full 40,000.

To a large degree, *Ventura*'s premier position is due to corporate America's adoption of the program as the de facto standard in professional document processing. But like any powerful program, *Ventura* offers features whose use doesn't come easily, even to the

PHOTOGRAPHY: TY HYMAN

veteran user. And assembling a publishing system, after all, requires a significant investment of money as well as time. The single-user *Ventura* 2.0 alone costs $895; *Professional Extension* 2.0 tacks another $595 onto that. The *Network Server* version together with a three-node *Network Pak* runs a little over $2,000.

Ventura became a force in the marketplace by giving the most punch for the price. Its automation capability, for one, enhances efficiency in processing books and long reports. Contrary to popular belief, it also has no problem handling shorter documents with the same ease—it just processes them more quickly. In a well-managed workgroup, the network version of *Ventura* does much to increase productivity gains in publishing.

The tips presented in the following section will help you optimize *Ventura* in order to get the most out of your desktop publishing investment, no matter what your level of expertise. Among the primary factors that deserve your attention are achieving high-quality output, integrating common office applications within *Ventura*, importing spreadsheet, database, and *Microsoft Windows* files, in addition to managing memory.



Knowing all your options for outputting *Ventura* files means controlling costs and maximizing both the appearance and the reproduction quality of your publications. A laser printer is most often used to print *Ventura* files; it has the ability to produce high-quality output for the majority of user needs. Color printers are also popular devices that offer results that enhance the appearance of publications produced in-house.

When the resolution of the laser printer is not acceptable for your high-end publications, however, it's time to think about using a typesetter. Preparing the layout in-house yourself and then sending the *Ventura* files to a type house for high-res output can represent considerable cost savings. After typesetting, the film or plates can then be forwarded to a print shop for high-volume color production.

TIP 1: You can use almost all the downloaded fonts and graphics you might want without adding more memory to your Hewlett-Packard LaserJet II (or compatible) printer.

If you own an HP LaserJet II configured with standard memory (500K), there are a few tricks to use when memory errors occur. First, always install both the 150-dot-per-inch and 300-dpi HP LaserJet drivers in *Ventura*. When the memory-intensive 300 dpi causes problems, switch to 150 dpi. The difference between the two printed resolutions is seldom obvious.

If you must have 300-dpi output, identify the problematic pages (those with extra-large fonts or huge graphic files) and print them one at a time. If the initial title page attached to a large *Ventura* chapter file is responsible for a memory error, send the title page on its own; then send the remainder of the chapter.

Even the most difficult pages can normally be printed if you reduce the resolution and print them separately. As a rule, users who stick to the 6- to 24-point font set *Ventura* automatically installs for the HP LaserJet almost never encounter memory problems.

TIP 2: You can use the HP PaintJet with *Ventura*, even though the program does not provide a driver to support this device.

You'll need to use the HP PaintJet driver supplied with Digital Research's *GEM/3 Desktop*. (*GEM/3 Desktop* comes bundled with several GEM applications, and it can also be purchased separately.) Under GEM, install the HP PaintJet. Next, copy the resulting PDHPJ9.ELQ driver from the GEMAPPS\GEMSYS directory to the VENTURA directory. Copy all fonts with .ELQ extensions from the GEMAPPS\FONTS directory.

Now turn to the Xerox 4020 color printer driver, available in *Ventura*. To get the necessary font width table, do a device-only install and select the Xerox 4020 as the output device.

From within *Ventura*'s Options, Set Printer Info menu, the HP PaintJet will now appear as an output option. Select it and change the font width table to XRX4020.WID.

To see what *Ventura* can do with the HP PaintJet, load the CAPABILI.CHP example file, make it colorful, and go print. Reverse text, tilted graphics, mixed font orientations, and, of course, color are all available!

TIP 3: Using *Ventura* is a great way to improve the appearance of general office correspondence. The program can even be used to perform mail-merge functions. The process is often just as fast as conventional methods, yet it produces documents with a superior professional appearance.

Here are instructions for creating chapters that will print a list of names to number 10 envelopes on a laser printer and, in a variation on that method, will merge the names in the list with form letters. Once you understand the basics of both operations, you can easily customize style sheets and chapters to accommodate the



You can access *Ventura*'s Options, Set Printer Info menu to change output devices and printer font width tables. Following the procedure described in the article, use *Ventura*'s Xerox 4020 color printer driver and *GEM/3 Desktop*'s HP PaintJet driver to add the PaintJet as an output device.

ILLUSTRATIONS: KEITH LO BUE

requirements at your office.

A. List printing to envelopes. The crucial factor in using this technique is that each record in the list must be a separate paragraph. This means a line break is used to end each line within the name/address record and a single return is inserted at the end of the record. You can create this kind of list using your word processor or follow the instructions in Tip 7 to generate one from your database.

For example, in *Ventura,* the list of names would appear as in Figure 1. In *Ventura,* a list of this type automatically manages variable record lengths and creates a new page for each envelope. Time and effort are conserved by using Body Text as the basis of formatting each record; this way, tagging is unnecessary.

(1) Create a new chapter.

(2) Go to the Chapter/Page Layout menu and change the Page Orientation to *Landscape;* select *Single* for page sides.

(3) Make the following modifications:

- Body Text:
  Font: For this example, use Swiss, 12 pt., bold
  Spacing:
  Above: 0
  Below: 0
  Interline: .194
  In From Left: 6.75
  In From Right: 0
  Breaks:
  New Page: After
- Set the Underlying Page/Frame with the following margins:
  Top: 4.00
  Bottom: 0
  Left: 0
  Right: 0
- For added design, make a repeating frame to border each address:
  Sizing and Scaling:
  Flow Text Around: Off
  Upper Left X: 6.37
  Upper Left Y: 3.98
  Frame Width: 2.62 (wider if necessary)
  Frame Height: 1.07 (taller if necessary)
  Ruling Box Around: Height of Rule 1: .010

Now just load the text file into the underlying Page/Frame. You can further enhance blank envelopes by placing your return address and company logo in repeating frames. (Turn Flow Text Around *off* for all repeating frames.)

B. Merging a list with a form letter. For form letters, position the name/address records as in the example above, but decrease the top margin of the underlying Page/Frame and the spacing in from the left for the Body Text. Load the form letter into a large repeating frame just below the point where the addresses end.



The above imported list is the first step toward using *Ventura* for improved office correspondence.

The date, company logo, and address information can all be included and placed into repeating frames. For large mailings, write your signature in a paint program, save the file, and load it into a repeating frame at the correct position in the form letter. (There is a limit of six repeating frames per chapter, so be sure to use them judiciously.)

TIP 4: Choose a type shop experienced with *Ventura* files. Though this may seem obvious, it is an important factor that is sometimes overlooked.

The Linotronic-series machines are probably the most common typesetting devices; they use the popular PostScript page description language, which offers perhaps the greatest ease and flexibility for accommodating *Ventura* files. But unlike your PostScript laser printer, which probably has dozens of typefaces built in, a type house must purchase and download these fonts.

Any type house owning a PostScript device is likely to own the entire Adobe Font Library as well. But it is always a good idea to confirm this, along with other information, in advance.

Here is a useful checklist for selecting a type shop:

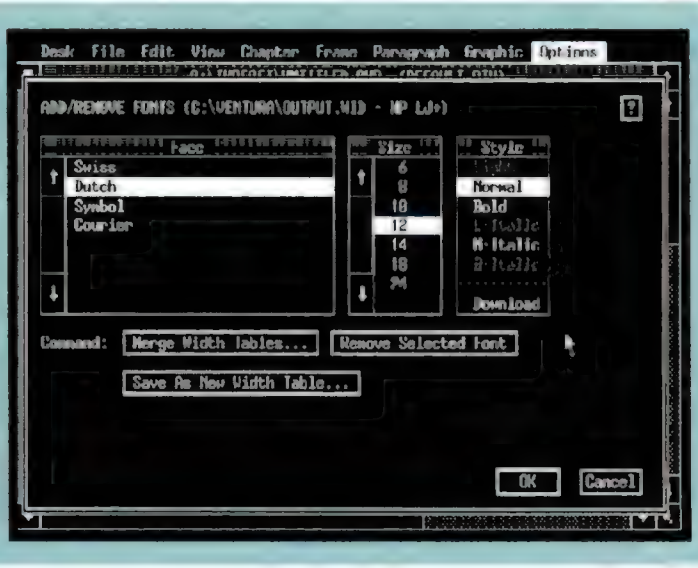
- Does it handle *Ventura* files?
- What typesetter does it use? Is it a PostScript device?
- Does it own the same fonts you'll be using?
- How does the shop want the files prepared:

a. Printed to file (using the print-to-file option that outputs chapter files in ASCII format)?

b. Printed directly as *Ventura* chapter files?

- What diskette formats can it read?
- What is its normal turn-around time and cost per page? (This varies with the resolution—635, 1,270, or 2,540 dpi—so be specific.) What is the rush charge?
- Are there different charges for film, plate, or repro positives and negatives?
- What printer-width table should you use? Does the shop supply any special

The Add/Remove Fonts menu lets you specify whether a font is resident at the printer or should be downloaded. Reduce the size of chapter files printed to disk for typeset output by changing the Style status of downloaded PostScript fonts to Resident (assuming your type shop owns the same fonts).



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ones? (Some Compugraphic typehouses will provide special printer width tables if they're using The Computer Group's *Typesetter's Connection*, which allows the Compugraphic to be selected as a direct output device.)

TIP 5: When spot-color printing, disable unused colors. The primary reason for using spot-color output is to reduce prepress setup charges that would otherwise be incurred when the print shop prepares color separations. But opting for spot color

> Spot-color output is used to reduce prepress setup charges, but you can waste money if files are sent to the type shop containing overlays of unused colors.

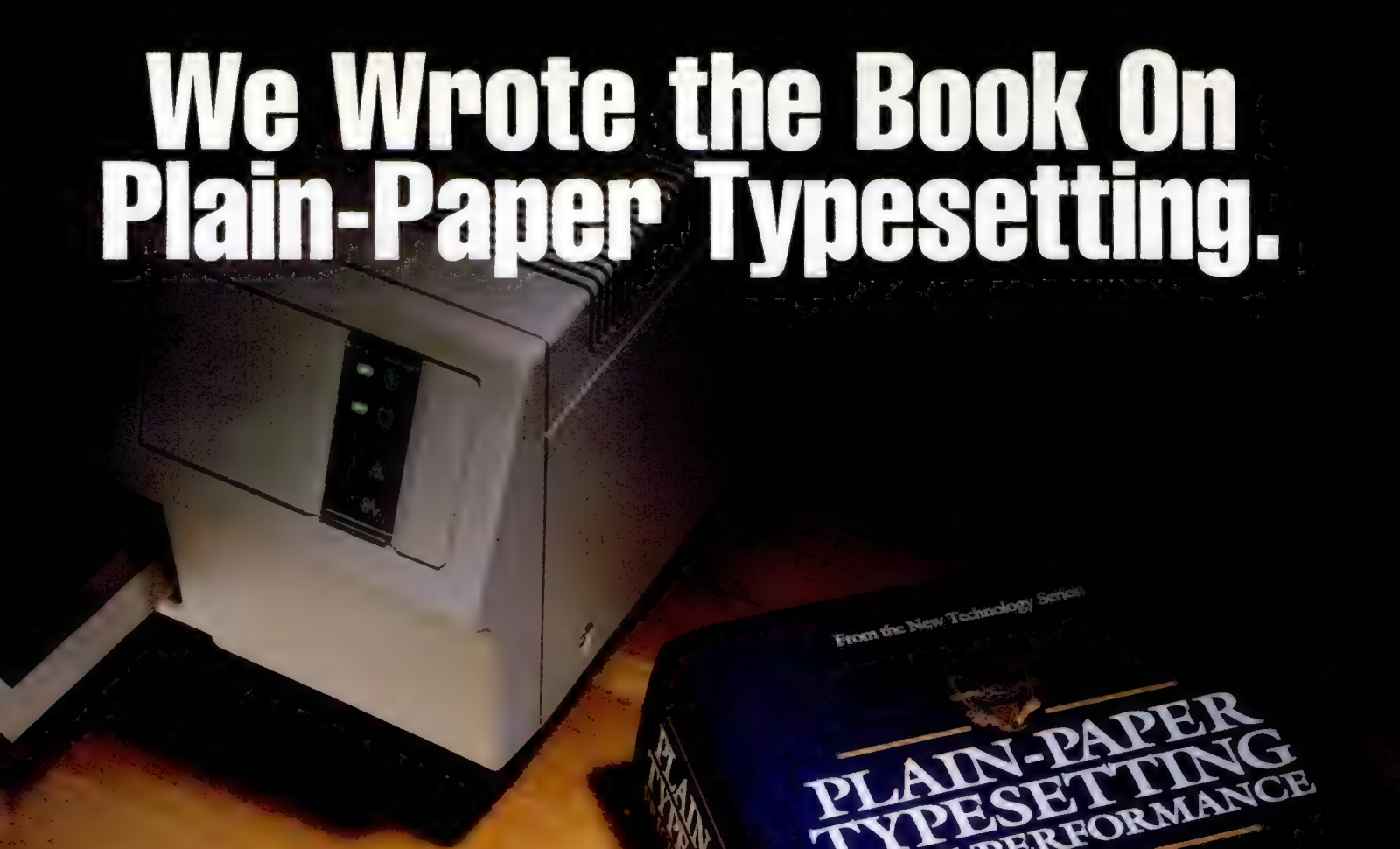
can actually waste money if files sent to the type shop contain overlays of unused colors. A two-color job, for instance, will print five additional overlays per page if all colors are enabled. If these go to film, you can calculate the damage at an average cost of $10 to $20 per typeset page.

You disable colors through *Ventura*'s Paragraph/Define Colors menu. For each unused color in the list, change the Color Setting to *Disable*. Black cannot be selected or modified; it will print regardless of its use in the chapter. To avoid paying for each unused black overlay, treat a color as "black" throughout the chapter.

For example, if you want the final output to make use of yellow and red only, disable one of those colors. If you disable red, change all instances of red in the chapter to black before sending the files to the type shop. Of course, this produces black and yellow overlays, but remember that both are actually set in black. If enough printable areas remain around the perime-

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We Wrote the Book On Plain-Paper Typesetting.



It Started With Laser Printers

When laser printers first came out, people hesitated to call them "typesetters." Even though they could handle complicated layouts, lots of different typefaces, and a full range of type sizes, the standard printer resolution of 300 x 300 dpi was too poor to compete with phototypesetting.

Laser printers had other limitations as well. If you wanted fast printouts, you'd have to restrict yourself to a few typefaces at a small number of sizes. If you wanted many typefaces in unlimited sizes, you were reduced to very slow print speeds.

LaserMaster Had A Better Idea

LaserMaster™ was the first to successfully tackle ALL of these limitations. Our introductory product, the LC2 printer controller, offered typeface flexibility, a range of type sizes from 4 to 1200 point, darkroom-style special effects, and super-fast print speed.

With the LX6 Professional controller, LaserMaster became the first to bring 600 x 300 dpi quality to popular laser printers like the HP LaserJet Series II. The LX6 Professional came standard with 35 fonts and the same array of type effects and options offered by the LC2, but provided even *faster* speeds and higher resolution. This boost in output quality put LaserMaster way ahead of the pack in the ongoing quest for true plain-paper typesetting.

The Price/Performance Advantage

Now with the LaserMaster 1000, LaserMaster has outdone itself again—*and* its nearest competitor, the Varityper VT600P. LaserMaster's 1000 x 400 dpi output provides more dots per square inch than Varityper's 600 x 600 dpi, at 10 times the print speed, and only half the cost.

The LaserMaster 1000 is powerful, sophisticated, versatile, and clean. It handles 120,000 pages per year (compared to Varityper's 30,000 per year). It comes with 35 Bitstream® typefaces and accepts hundreds more, in any size from 4 to 1200 point, all quickly scaled on-the-fly as you need them. It works with any GEM or Windows application, including Ventura Publisher and PC PageMaker. It also offers CAD, word processing, and PostScript® language capability. It requires little maintenance and uses neither developer (like Varityper's model) nor noxious chemicals (like phototypesetting systems).

So if you've been waiting for a plain-paper typesetting system that meets your needs for quality, speed, and typographic sophistication, at a price you can *finally* afford, take a look at the price/performance advantage of the LaserMaster 1000.

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ter, the color names black and yellow appear. When you send the overlays out to the print shop, you'll want to prevent confusion by whiting out the color name "black," or pasting over it the "red."

TIP 6: To reduce the size of files printed to disk, specify fonts as *Resident*.

When using downloaded PostScript fonts, change their Style status to *Resident* in preparation for printing a chapter file to disk for typeset output. (If your type shop does not own the same fonts, you'll have to leave their status as *Download*.)

Often, the information that makes up publications like financial reports, research summaries, catalogs, office correspondence, and technical documentation originates in applications apart from word processors (see the sidebar "Desktop Publishing: Management by Objectives"). You need to know the most efficient way to extract data from spreadsheets, databases, and graph and charting applications. The following tips will help you optimize integration and increase productivity in your office.

TIP 7: You can use your database to generate a label file for *Ventura* mailmerging. Here we will present a program

DESKTOP PUBLISHING: Management by Objectives

by Tami Peterson

Desktop publishing is only as efficient as the people who use and manage it. But as obvious as this statement may appear, unproductive practices abound. Too often, publications are thrown together haphazardly; no plan exists up front for the proper management of copy-editing tasks, file-formatting procedures, file-tracking issues, and other elements that can affect both the cost and the time spent on a project. Because of the multitude and variety of tasks involved, implementing publication management policies to deal successfully with these issues will save you and your company both money and labor in the long run.

In some companies, desktop publishing is managed by someone whose title is publisher and who assumes the responsibility for establishing submission schedules. In other companies, the "desktop publisher" is an individual who has been promoted from a word-processing position and is supervised by a desktop publishing manager. In either case, one person should retain the authority to set schedules and establish guidelines—for a variety of departments—that define when and how files should be submitted.

The following suggestions will help DTP managers achieve these objectives. While we provide explicit details for *Ventura Publisher*, the basic concepts apply to working with all desktop publishing products.

■ Begin by establishing one basic rule: No files (whether text, tables, or graphics) are to be delivered to the desktop publisher before all involved parties have been given the opportunity to offer their final approval.

■ If you as the manager are not operationally proficient with *Ventura*, work closely with your desktop publisher to develop publication plans. Otherwise, you run the risk of overlooking critical tasks and file-formatting considerations that will affect your deadline. (Improperly formatted text within word processing files is often a major source of delay. Text should be set aligned left, ragged right. Don't bother spending time on extraneous formatting—such as bold or underlining to offset headings—that is not intended to be reproduced the same way in the *Ventura* documents.)

There's a popular belief that the desktop publisher can quickly, almost magically, produce your company's publications simply by importing sloppy files in random formats into *Ventura Publisher*. A good DTP manager knows better—and will implement procedures that avoid such a haphazard approach.

■ A well-thought-out plan will facilitate production of a publication with numerous contributors. Take, for instance, a quarterly financial report that is to include text, *Lotus 1-2-3* tables, and graphics; different files may originate from the marketing, finance, and research departments. All will be integrated by the desktop publisher using *Ventura*.

To ensure that all materials reach the desktop publisher early enough for the report to be finished on schedule, it is necessary first to analyze the project and develop a production outline. To do this, break the report into distinct elements, then designate the person or department who will be held accountable for each. If, as in the adjoining "Production Outline," responsibilities are categorized by department, then individual assignments may be left up to the department managers.

■ Consider the tasks, such as copy editing, that need to be accomplished in order to produce *Ventura*-ready files from all of the departments involved. Assign realistic time values to each task, bearing in mind the publication's deadline.

Don't overlook any preproduction tasks, such as style sheet design and approval, spreadsheet file import to other applications for graphics production, or

for creating records in this format:

First Last
Title
Company
Address
City, ST ZIP

The instructions that follow are specific to *FoxBASE Plus*, but it is a useful example to follow, because the actual syntax is practically generic to any popular database application. The key ingredient is the addition of a separate field—a *Ventura*-recognized code. This code, a line break (<R>), is used to convert each record in the resulting text file to a single "paragraph" in *Ventura*.

(1) We begin with the assumption that eight fields exist in the database:

FIRST
LAST
TITLE
COMPANY
ADDRESS
CITY
STATE
ZIP

(2) Enter the following commands:

```
REPLACE ALL RETURN WITH '<R>'
MODI LABEL FILENAME
```

(3) The last command above presents the following list of parameters on-screen. Enter these values:

Height of Label:	5
Width of Label:	80
Left Margin:	0
Lines Between Labels:	1
Spaces Between Labels:	0

cleaning up spreadsheet tables for text import. For example:

Graphics 1–5
Deadline for analysts to approve spreadsheet data: 11/2
Tables printed to disk, ready for graphics production: 11/3
Graphics in .CGM format, routed to desktop publisher: 11/6

■ Whenever possible, establish file-naming conventions to be used and include them in the production schedule. Using this method facilitates file tracking in instances like the one shown above, where the same file will be handled by more than one person.

■ Give everyone who is involved a copy of the production schedule. Demand that they adhere to this schedule and keep it up to date.

■ After production is finished, evaluate the success or failure of the procedure you have created. Consider making improvements on it for your next publishing cycle. As your contributors grow more and more sophisticated, for example, you can ask them to embed *Ventura* tags in the word processing files they hand in. This procedure saves production time, as files imported to *Ventura* will automatically appear with the formatting established in your style sheet (fonts will be changed, line rules added, and so on).

PRODUCTION OUTLINE:

QUARTERLY FINANCIAL REPORT

Four text files, in four *Ventura* chapters:

Chapter 1 text:	Marketing Dept.	☐
Chapter 2 text:	Marketing Dept.	☐
Chapter 3 text:	Finance Dept.	☐
Chapter 4 text:	Research Dept.	☐

35 *1-2-3* tables, broken down by *Ventura* chapter and number:

Tables, Chapter 1, 1–8:	Marketing Dept.	☐
Tables, Chapter 1, 9–12:	Finance Dept.	☐
Tables, Chapter 2, 13–17	Finance Dept.	☐
Tables, Chapter 2, 18–25:	Marketing Dept.	☐
Tables, Chapter 3, 26–35:	Research Dept.	☐

Five graphic files, broken down by *Ventura* chapter:

Graphics, Chapter 2, 1–5:	Marketing Dept.	☐

MANAGEMENT ON A NETWORK

While good publication-management practices are always important, they become absolutely crucial for managers in charge of a *Ventura* desktop publishing network.

In the network version of *Ventura Publisher*, the program files are installed as read-only, and all chapter files are protected against having more than one user gain full read/write privileges at the same time. The Browse feature allows a user to view, but not alter, a chapter that another user has already opened.

Remember, though, that a *Ventura* chapter file is not a composite of all the files used to create what appears on your screen. It is more like an instructional file that tracks all ancillary files that make up a chapter. Though it is safeguarded in a network environment, the ancillary files it references are not equally protected.

To prevent a desktop publisher or anyone else from having to amend an ancillary file outside of *Ventura*—and to avoid the problems that can result from this—make sure that everyone observes the cardinal rule of having such files approved before they are forwarded for referencing.

Good publishing habits, along with an awareness of *Ventura*'s file-management and network features, will protect you from potential disasters. The productivity benefits of using *Ventura* in a multiuser environment certainly warrant any time you can spend developing a process that suits both your contributors and the producers of your publications. ■

Numbers of Labels Across: 1

(4) On the next screen, enter these values:

```
1 TRIM(FIRST)+'_'+_TRIM_(LAST)_+
_RETURN
2 TRIM(TITLE)_+_RETURN
3 TRIM(COMPANY)_+_RETURN
4 TRIM(ADDRESS)_+_RETURN
5 TRIM(CITY)+'_'+_TRIM
(STATE)+'_'+_TRIM (ZIP)
```

Steps **(5)** and **(6)** are

```
INDEX ON LAST TO TEMP
LABEL FORM FILENAME TO VENBASE
```

(7) Load the resulting file, VENBASE .TXT, into *Ventura* in ASCII format. This is very important, as the result from the above program would otherwise be zero returns between records in *Ventura*. (*Ventura* will recognize two returns as one when reading ASCII files.)

The above list could be used for the examples of mail-merging we discussed in Tip 3. If you're generating a report or other output that should be presented in a columnar format, substitute a field called Tab for the Return field. Then replace Tab with the code <9> and insert accordingly into the syntax. This code will be recognized in *Ventura* as a tab character.

TIP 8: *Ventura*'s *Professional Extension* accommodates Lotus .PRN files with its PRN-to-Table import option, but you may prefer to format your numerical data for *Ventura* 2.0 *or Professional Extension* using tabs as the basis for alignment. If so, you can effectively use your word processor to replace the spaces between spreadsheet columns with tabs.

If you're using *Microsoft Word*, for example, you can take advantage of its automatic replacement feature, available under the program's spreadsheet linking option. First bring the spreadsheet file into *Word*, then follow the instructions below to replace spaces with tabs for worksheets in .WKS, .WK1, or .XLS formats:

(1) In *MS Word*, go to the Library option.
(2) Choose Link.
(3) Enter the filename or a wildcard (*) specification such as C:\LOTUS*.WK1; then hit F1.
(4) If you've entered a wildcard specification, point to the correct filename.
(5a) If you want to bring in the entire spreadsheet, hit Enter.
(5b) If you want to extract only a range, hit the Tab key before hitting Enter. This will position you in the Area option. If the table already has a range name, type this. If not, just enter the spreadsheet value range (for example, A1..G8).
(6) Hit Enter.

The program now inserts a tab between each pair of columns in the spreadsheet. If the "insert an extra column" method was used to create space between data columns, you'll find extra tabs between these columns; remove them before loading the file into *Ventura*. If you didn't use your spreadsheet's alignment feature (you used the Spacebar to push data into position within cells), the extra spaces will transfer with the data. Delete them.

A hidden text line is created and retains the link to the spreadsheet from within the text file. This must be deleted before loading the file into *Ventura*.

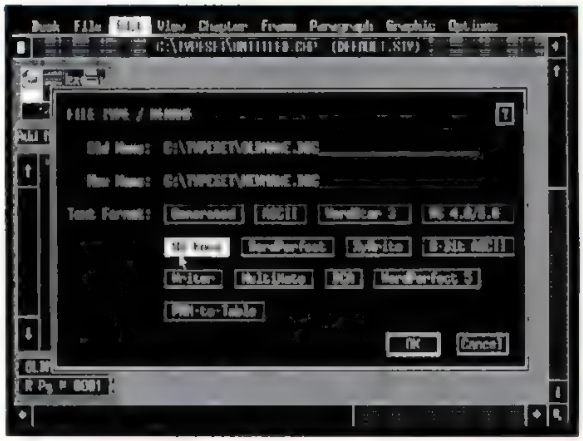
At the end of each line, there is a line break (an arrow pointing down and left) instead of a return (a new-paragraph character). As a result, the entire table is really

VENTURA'S CONVERSION FACTOR

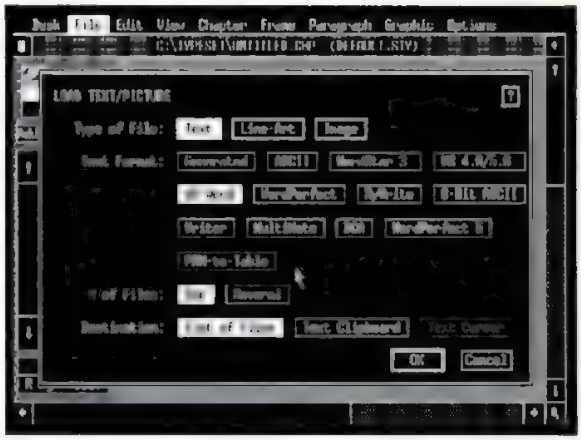
by Tami Peterson

***Ventura* accepts 27 different text, graphics, and image file formats. It also exports 13 text file formats and two different graphics formats. While this makes for tremendous integration flexibility within the program, you can also use *Ventura* as a handy text and graphics file converter for your other applications. Here are some of your options:**

Share your text files with users of different word processors. Load any text-supported file into *Ventura* and use the Edit, File Type/Rename menu to convert and save it in the new format. When converting ASCII files, the returns are eliminated and the text word-wraps.



Combine text file formats into one file by using Text Cursor or Text Clipboard. The Text Cursor feature is activated only when you are in Text Mode and have the cursor positioned within a currently loaded file before entering the File, Load Text/Picture menu.



one large paragraph. *Ventura* has a size limitation for paragraphs; any paragraph with more than 8,000 characters will be rejected. For this reason, it may be necessary to break larger tables into a series of data ranges while you import them from other programs, replace some line breaks with returns where possible, or both. Remember also that *Ventura* has a limit of 16 tab settings per paragraph.

If your word processor does not incorporate an automatic replacement feature, its own search/replace option can speed the process of taking a .PRN or ASCII file and replacing all the spaces between columns with tabs.

Ventura limits the size of a paragraph, rejecting those larger than 8,000 characters.

After loading the file from the spreadsheet, locate the area with the largest number of spaces between columns. Count those spaces. Then set the Search command for that number of spaces and set Replace with a tab character.

Once the largest column width has been replaced with a tab, continue the process counting down one space at a time in the Search command. If only one space originally exists between columns, use your word processor's column selection option (if it has one) to replace spaces.

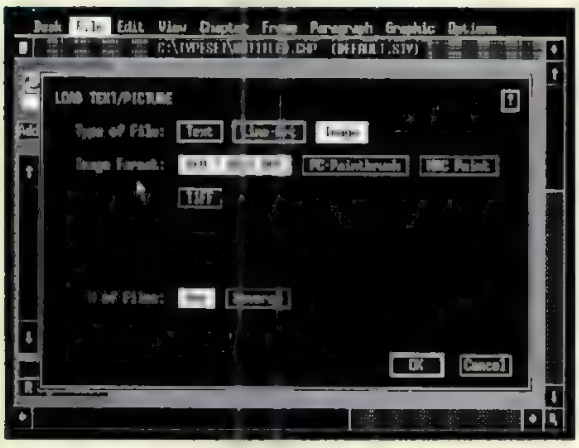
TIP 9: *Microsoft Excel* is a popular tool in many corporations. Unfortunately, it outputs only to its proprietary .XLC format. Here are two ways to get your *Excel* Chart files into *Ventura*.

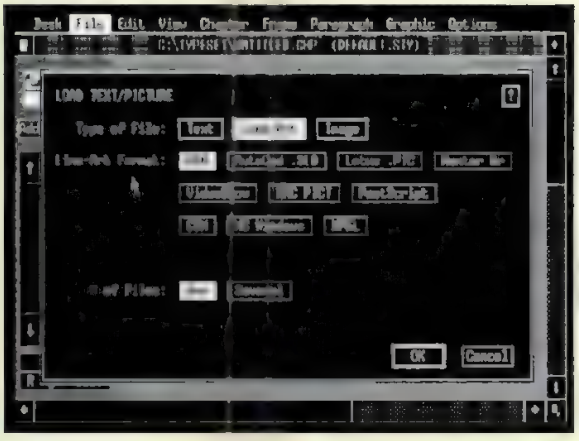
If you merely need to get the graphic elements of your chart into *Ventura* (no text elements), copy the Metafile converter program CLIPV2.EXE from the *Ventura* utilities disk to the *Windows* directory. Open the *Excel* Chart file you want to use, maximize its window, select the chart, then use Shift-Edit to get to the Copy Picture menu. This pastes the picture onto the *Windows* clipboard in Metafile format (which *Ventura* can use). Run CLIPV2.EXE; this automatically loads the Metafile image from the *Windows* clipboard. Maximize the CLIPV2 window and save the pasted file.

If you do need both text and graphics, try the second option. (This method is also useful for importing images that cannot be produced in Metafile format, like bitmap images.) All *Windows* applications can print using any supported *Windows* device; the HP plotters are among these devices, and *Ventura* accepts .HPG files.

(1) Open the WIN.INI file.
(2) Add a disk file as an output port (for instance, CHART.HPG = COM1:).
(3) Save and exit *Windows* (to activate WIN.INI settings).
(4) Open Control.EXE and install an HP plotter as an output device. (The 74 series or Color Pro options work best.)
(5) Change the paper method from *manual* to *preloaded*.
(6) Change the Connections menu for the HP plotter, choosing the filename output port used earlier.

The chart prints to an .HPG format that is compatible with *Ventura Publisher*. All of the solid colors will convert to black during the process; to avoid this, make





You can save disk space otherwise eaten up by non-GEM graphics files stored in *Ventura* chapters. When loading a non-GEM graphics file stored in any line-art or image format, *Ventura* automatically creates a GEM (.IMG or .GEM) file. For every non-GEM file in a chapter, there is a redundant GEM file. To avoid taxing your hard drive, remove the non-GEM file from the *Ventura* chapter and load the duplicate .IMG or .GEM file. Once you have saved the GEM graphics file with the chapter, you can delete the original non-GEM graphics file—as long as it is not needed for another application. ■

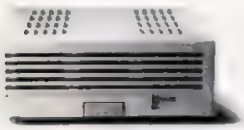


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sure you assign specific patterns to the data categories in the Chart's Format, Patterns menu.



One of the most important functions of the *Ventura* system manager (especially when in charge of network workgroups) is ensuring that things run smoothly for users. Be sensitive to user preferences, informed about memory management, and well versed in *Ventura*-related publications.

TIP 10: Make a different VP.BAT for each user on the same system, so that individual users' preferences are saved.

This process is mandatory for network users of *Ventura*. But the same concept can be applied to nonnetworked systems that serve as "community desktop publishing workstations." To preserve setup preferences, along with frequently used directory paths, modify and rename the VP.BAT for each user.

Create a different directory for each user. Add the /I=*n* statement to each VP.BAT (see the diagram "Taking Charge of Ventura"), where *n* is the drive and directory just created. Copy VP.BAT to a file called, say, MARY.BAT (for an employee of that name), and continue for all.

TIP 11: Reduce disaster calls; teach "The Three Steps of Saving."

You can prevent new users from overwriting style sheets between chapters by teaching them a three-part check system as a beginning save routine. Point out that the following steps are followed in *reverse* order of their appearance in the File menu:
(1) Go to the File menu, choose Save as New Style . . . (After naming, be sure they notice that the new filename will appear on the Title Bar. Likewise in step 2.)
(2) Go to File, Save as . . .
(3) Go to File, Save . . . (thereafter)

TIP 12: Every system administrator ought to know how to activate *Ventura*'s hidden diagnostic menu.

TAKING CHARGE OF VENTURA

Ventura Publisher offers an excellent device-only install, which permits you to change printers, monitors, or mice at any time without bothering to reinstall the entire application.

To change several of *Ventura*'s settings, however, you don't even need to run the device-only install. If you understand the significance of each switch in the program's start-up batch file, VP.BAT, certain device changes and numerous other options can readily be within your control.

VP.BAT

```
CD C:\VENTURA
DRVRMRGR VP %1
 S=SL_HER~5.EGA M=12 X=I: C=D:
I=C:\USER1 E=256/A=1t F=32 H=0
```

/S.../M=

Ventura autoinstalls the options up to and including the /M switch. (The /I switch is autoinstalled with the network version.) All other switches must be manually appended. If you are using *Professional Extension* with the Edco hyphenation dictionary installed, additional options are available.

%1

The %1 allows any chapter name following the batch command to load automatically. To run *Ventura* and simultaneously load a chapter named CHAPNAME.CHP, for example, type "VP CHAPNAME.CHP".

/S=

This switch, which establishes the screen fonts *Ventura* will use, can be either edited here in the VP.BAT or changed during a device-only install. The extension can also be modified from within *Ventura*'s Option, Set Printer Info menu.

/M=

This is the mouse selection. The first number describes the port, the second number denotes the type.

Port	Type
0 = COM1	0 = No mouse
1 = COM2	1 = Mouse Systems or PC Mouse
2, 3 = Any ports other than COM ports	2 = Mouse using MOUSE.COM or MOUSE.SYS
	3 = Microsoft Mouse or IBM PS/2 Mouse

/X=

This specifies an additional drive *Ventura* should recognize. To add more than one, repeat the switch.

/O=

This switch tells *Ventura* where it should send overflow files. A RAM drive can be designated here if desired.

/I=

This designates the drive where *Ventura* is to store the .INF files, which preserve all preference settings. A directory can also be specified. (You will want to insert this switch manually if you use *Ventura* on nonnetworked systems that serve as "community desktop publishing workstations.")

/E=

Here you can specify the maximum amount of EMS memory you want *Ventura* to consume. This switch is used only by *Professional Extension* and the network versions, as the base system will not use any more than 128K of EMS.

/A=

This switch lets you take memory ordinarily reserved for the screen graphics and fonts buffer (up to 32K) and add it to the text area. But when it comes to resolving low-memory situations, it is only a Band-Aid; it should be used *only* in conjunction with PostScript output devices.

/F=

The /F switch allocates screen font memory; without this switch, the default is 68K. (Valid specifications are from 32K to 170K.) Specifying a number less than 68K can alleviate memory problems by forcing *Ventura* to take less conventional memory while loading. Using a number greater than 68K reduces the time it takes to redraw screens.

/H=

When HIMEM.SYS is installed on your system for other applications and you don't want *Ventura* to recognize it, set /H=0.

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HyperDisk uses any type of memory in your computer—conventional, extended or expanded. It installs as a DOS device driver or terminate and stay resident (TSR) program. HyperDisk supports hotkey controls for instant response. Operating parameters, including cache size, may be changed after installation without rebooting your PC! HyperDisk is compatible with virtually all PC applications, including Windows,™ DESQview™ and Concurrent DOS,™ making any program faster.

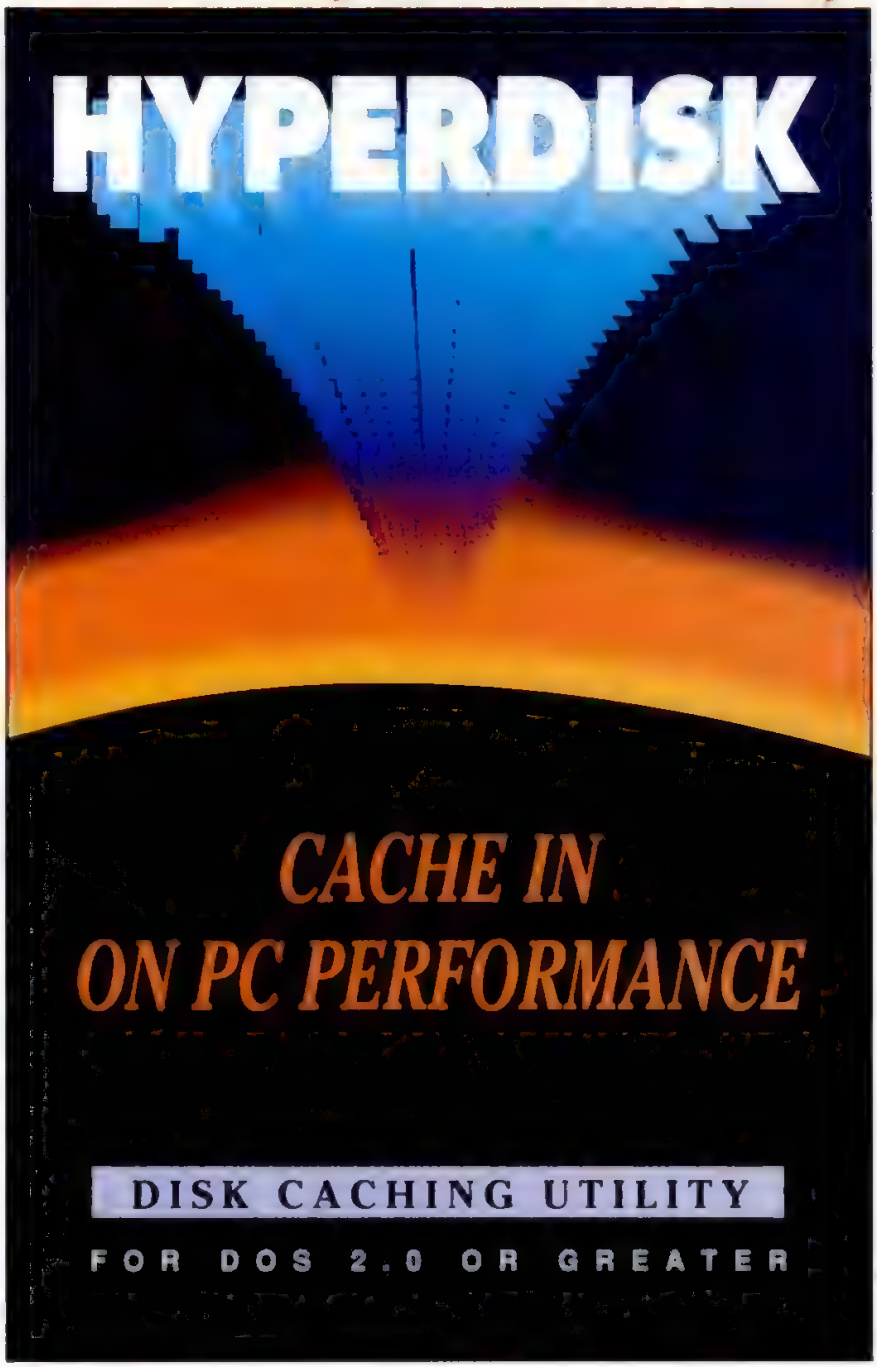
HyperDisk Looks Ahead

When an application needs information from your disk, a read operation is performed. HyperDisk intercepts this request and copies the data from the disk to its cache memory, then passes the data on to the program. All subsequent requests for the same data are copied from the cache! Anticipating which data will most likely be requested next, and holding that data in memory, gives HyperDisk its blinding speed. Copying from memory is many times quicker than copying from a disk, so your computer works incredibly fast!

HyperDisk is fully automatic. If a disk request for new data is issued after the cache memory becomes full, HyperDisk makes space available to hold it. HyperDisk continually updates your disk while your PC is idle, so processing is not interrupted. The "least recently used" data is flushed from the cache, making room for the newly requested data. HyperDisk automatically copies to disk all changed data so you cannot lose information (even if you reboot). No user intervention is necessary.

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This menu reveals the size and allocation of all memory. To access it, first select the Desk, Publisher's Info menu. The ensuing dialog box contains the version, date, and serial number and two rectangular outlines just above the copyright line. The left one contains the company name, Ventura Software Inc. Click on the word *Ventura* here, and the diagnostic dialog box will appear.

TIP 13: Send overflow files to a RAMdisk or local drive.

One of the many modifications you can make to the VP.BAT file is to designate a separate disk, generally a RAMdisk, for overflow files (see the diagram "Taking Charge of Ventura"). When *Ventura* is running on a network, you can utilize the same switch to improve performance by sending overflow files to the local hard disk. For example, if the local drive is C:, just add the following switch to the VPNET.BAT:

```
/o=c:
```

TIP 14: When base memory is low, there's one solution to *avoid*.

When you try to load *Ventura* but not enough conventional memory is available, the program displays a message to that effect before aborting. It suggests that you remedy the memory shortage by adding the approximate amount to the /A switch in the VP.BAT. Using the /A switch, however, can produce adverse results if you're printing to anything other than a PostScript device. Rather than risk further disaster, avoid the /A switch altogether. Instead, investigate your CONFIG.SYS and AUTOEXEC.BAT files and reduce the amount of memory you configure for *Ventura* and your version of DOS. For instance, our informal experiments show that a CGA system without EMS or HIMEM.SYS will not need as much as 550K to run *Professional Extension* or a network version of *Ventura Publisher*. DOS 3.3 will also reduce the CHKDSK value needed for *Ventura* to run.

Note that since *Ventura* displays only in black and white, it is usually unnecessary to choose anything other than the program's two-color mode for EGA and VGA displays. The exception would be if you are using color in your publications or if you are printing to a color printer.

DOWN MEMORY LANE WITH VENTURA

If you're running *Ventura Publisher* on a network, no doubt you're already using expanded memory or the *Windows* driver HIMEM.SYS. But even if you're running *Ventura* on a standalone system, you should be aware of how effectively EMS and HIMEM.SYS can cut down the amount of conventional memory you need to devote. This diagram shows the amount of RAM required to run *Ventura* under several typical system configurations.

Although only *Professional Extension* and the network version offer full support for expanded memory, Version 2.0 will place a small amount of application code into available EMS. Note that the addition of HIMEM.SYS produces excellent results for all versions, as *Ventura* falls for the pseudo-conventional memory this driver manufactures from XMS. (You can see from the chart that in some instances it is imperative to add HIMEM.SYS or EMS, particularly when network drivers are involved.)

All tests were performed on a Compaq 286 system using DOS 3.2, with Files and Buffers each set to 20 in the CONFIG.SYS file. No modification was made to the VP.BAT or VPPROF.BAT files, which would allow for further memory enhancement.

The amounts of memory actually required may vary depending on the monitor you configure for *Ventura* and your version of DOS. For instance, our informal experiments show that a CGA system without EMS or HIMEM.SYS will not need as much as 550K to run *Professional Extension* or a network version of *Ventura Publisher*. DOS 3.3 will also reduce the CHKDSK value needed for *Ventura* to run.

Note that since *Ventura* displays only in black and white, it is usually unnecessary to choose anything other than the program's two-color mode for EGA and VGA displays. The exception would be if you are using color in your publications or if you are printing to a color printer.

Minimum CHKDSK Values Needed For *Ventura* To Run

Professional Extension
(with base system) and network version

640K conventional memory

EGA 2-color monitor
With conventional memory only: 570,024 bytes
With HIMEM.SYS: 508,232 bytes
With EMS: 464,792 bytes
With EMS and HIMEM.SYS: 403,000 bytes

VGA 2-color monitor
With conventional memory only: 571,544 bytes
With HIMEM.SYS: 509,752 bytes
With EMS: 465,352 bytes
With EMS and HIMEM.SYS: 403,560 bytes

VGA 16-color monitor
With conventional memory only: 596,488 bytes
With HIMEM.SYS: 534,696 bytes
With EMS: 467,256 bytes
With EMS and HIMEM.SYS: 405,464 bytes

Ventura Publisher, Version 2.0

640K conventional memory

EGA 2-color monitor
With conventional memory only: 556,232 bytes
With HIMEM.SYS: 506,728 bytes
With EMS: 498,360 bytes
With EMS and HIMEM.SYS: 475,944 bytes

VGA 2-color monitor
With conventional memory only: 557,752 bytes
With HIMEM.SYS: 508,248 bytes
With EMS: 499,880 bytes
With EMS and HIMEM.SYS: 476,504 bytes

VGA 16-color monitor
With conventional memory only: 582,696 bytes
With HIMEM.SYS: 533,192 bytes
With EMS: 524,824 bytes
With EMS and HIMEM.SYS: 478,408 bytes

(Source: *Ventura Publisher* Application Note #2)

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TOEXEC.BAT for extraneous options and TSRs that can be modified or eliminated; it *is* possible to run *Ventura* on any nonnetworked PC equipped with a minimum of 640K.

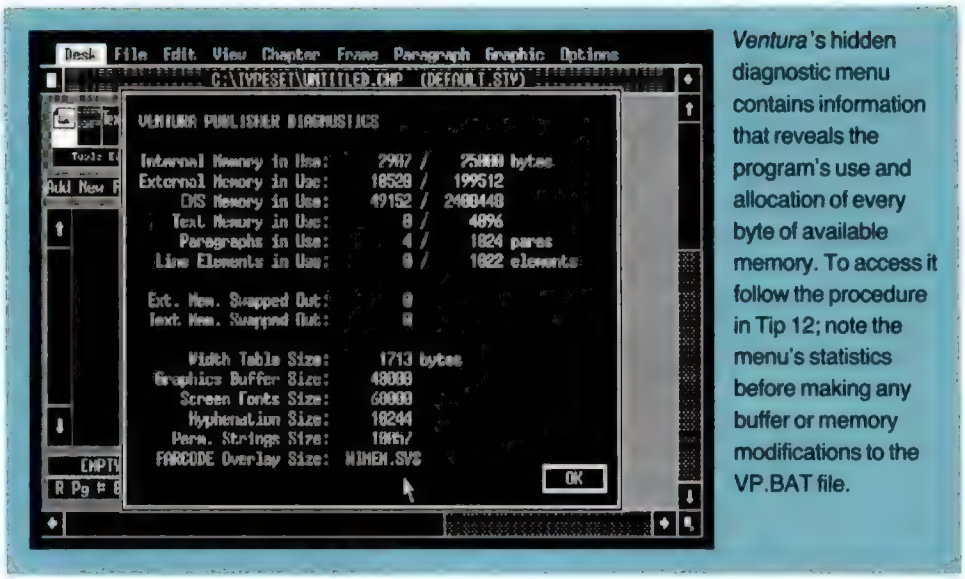
TIP 15: There are many options for overcoming memory shortages caused by network overhead. Here are some of the most reliable.

The network version of *Ventura Publisher* directly supports Novell, 3Com, and IBM network environments. Though not specifically listed in the installation menu, other networks will work; Banyan's *VINES* is an example. What all networks have in common is the need to utilize a certain amount of conventional memory at the local workstation. Memory requirements will vary greatly among networks—but also among workstations running on the same network. This is mainly due to different options in use.

When memory is a problem, your first step should be to investigate all possible reductions in the driver set and user profile. Also, look to reduce or eliminate unnecessary environment modifiers, excessive paths, last drives, or large file and buffer statements; all are responsible for heisting precious memory.

When memory is a problem, reduce or eliminate unnecessary environment modifiers, excessive paths, last drives, or large file and buffer statements; all heist precious memory.

If you still have a memory shortage, the optimal way to increase your supply depends on your system. If you have a 286-based PC, you may want to spend the money for an expanded memory board. If you already have extended memory in your 286, you can use an expanded memory manager to simulate EMS; there's no noticeable speed degradation in going this route. You can also use HIMEM.SYS, a driver included with *Microsoft Windows*. HIMEM.SYS essentially adds 64K to conventional memory. Some programs cannot utilize this "high" memory, but *Ventura* does. The memory can't be verified through a normal CHKDSK, but it can be viewed with certain memory managers or by entering *Ventura*'s hidden diagnostic menu.



Ventura's hidden diagnostic menu contains information that reveals the program's use and allocation of every byte of available memory. To access it follow the procedure in Tip 12; note the menu's statistics before making any buffer or memory modifications to the VP.BAT file.

To install HIMEM.SYS, just copy the driver to your root directory, and include the following line in the CONFIG.SYS:

```
DEVICE=C:\HIMEM.SYS
```

Then reboot.

If you have a 386 machine, emulating EMS in extended memory is the fastest, most cost-effective choice. Just beware of the trade-off that exists because of the means! The utility you use may appropriate a significant amount of conventional memory, thereby nullifying the effort. A good choice for 386 systems is *Expanded Memory Manager 386* from Quarterdeck Office Systems. It requires only 1K of conventional memory, it's easy to install, and it works.

TIP 16: Increase screen buffers to speed operation.

The /F switch you create in the VP.BAT file has one of two uses here. Reduction of RAM in the buffer will force *Ventura* to take less conventional memory while loading (no /F switch assumes the default, 68K). Conversely, if EMS or HIMEM.SYS has freed excessive conventional memory, this memory can be added to the screen buffer to increase the speed with which screens are redrawn.

To determine how much conventional memory you might use for this purpose, go to the hidden dialog box and note the external memory remaining. When you are using Version 2.0, the amount over 100K can be added to the /F switch. If you're using *Professional Extension* or the network version, the amount over 48K can be used—when EMS is available.

TIP 17: Steep yourself in *Ventura* literature. You don't want the people you support to stump you with questions you can't answer.

Books worth reading include Ted Nance's all-time favorite, *Ventura Tips and Tricks* (Peachpit Press, (415) 527-8555, $18.95) and Rick Altman's *Ventura Power Tools* (Sybex Inc., (800) 227-2346, $34.95). The latter's emphasis on productivity is reinforced by the inclusion of several valuable utilities. *Ventura Professional*, a publication of the Ventura Professional Users Group in San Jose ((408) 227-5030), is an excellent source that offers information pertinent to all levels of users. A year's subscription costs $36; since the magazine is published on a monthly basis, it has the significant advantage of keeping you up to date on the latest evolutions of the most powerful DTP program written for the PC. ■

Tami Peterson owns Decorum Corp., a New York–based firm specializing in Ventura Publisher *project consulting.*

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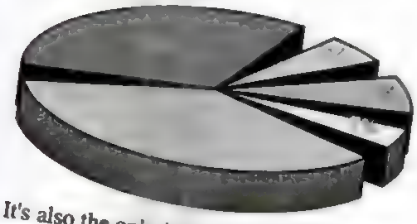
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It's also the only laser printer to feature a National Semiconductor 32-bit microprocessor. So you can print even sophisticated graphics faster than ever before.

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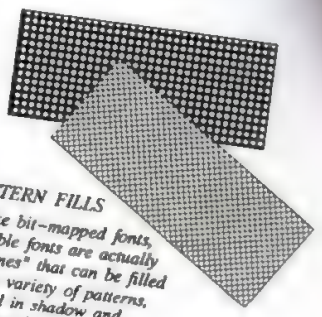
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PC MAGAZINE — EDITOR'S CHOICE
Data World 386-20
May 30, 1989
Dataworld's DATA 386-20 and DATA 386-25 stand out in the 20- and 25-MHz categories for speed and quality construction." (May 30, 1989)

PC MAGAZINE — EDITOR'S CHOICE
Data World Data 386-25
May 30, 1989
"The Dataworld Data 386-20 minitower and Data 386 full-size tower are good values and first-rate performers from an up-and-coming mail-order firm...

PC MAGAZINE — EDITOR'S CHOICE
Data World Data 386-16
February 28, 1989
"The Dataworld offers a 16-bit video system with a top-quality NEC Multisync II monitor and an exceptionally fast disk-drive controller for an impressive combination of value and performance... from a vendor with an increasing reputation for quality." (Feb. 28, 1989), 16 MHz system.

PC MAGAZINE — EDITOR'S CHOICE
Data World Portacomp II
October 11, 1988
"The Portacomp II is a value leader with fast memory, a fast drive controller and a terrific keyboard... Marvelously cheap powerful alternative... outperformed the other 286's. (Oct. 11, 1988)



DATA 386-20[A]

STANDARD CONFIGURATION

- Intel 80386-20 microprocessor
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- NEC Multisync II monitor capable of 1024x768 interlaced
- Socket for Intel 80387 numeric coprocessor
- 1 32-bit, 1 8-bit and 6 16-bit slots
- 1:1 dual hard/floppy controller
- 1.2MB 5.25" floppy drive
- Enhanced 101-key "click" touch keyboard
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- 230W power supply

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- Full-size vertical case or mini-tower case
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DATA 386-25[A]

STANDARD CONFIGURATION

- Intel 80386-25 microprocessor
- 1MB base memory RAM, expandable to 16MB of 32-bit memory
- 64K of 25ns static RAM cache
- 66MB, 25ns Hard Disk (many other sizes available as an option)
- Orchid Prodesigner Plus VGA card. 512K capable of 1024x768 with 16 colors
- NEC Multisync II monitor capable of 1024x768 interlaced
- Built-in ROM setup and diagnostics with EGA/VGA emulation
- Socket for Intel 80387-25 or Weitek numeric coprocessor
- 1 32-bit, 8 16-bit and 1 8-bit slots
- 1:1 dual hard/floppy controller
- 1.2MB 5.25" floppy drive
- Enhanced 101-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

AVAILABLE OPTIONS

- Full-size vertical case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB
- Numeric coprocessor: 80387 or Weitek
- 20MB to 300MB hard drives with MFM, RLL, ESDI, or SCSI interface
- 40MB - 120MB tape backup drives
- Available in standard monochrome (720x348, amber), standard VGA (640x480, color) or extended VGA (800x600 up to 1024x768, color)
- 1.44MB 3.5" diskette drive

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DATA 386-16[M] / -20[M] / -25[M]

STANDARD CONFIGURATION

- Intel 80386-16, or -20, or -25 microprocessor
- 1MB base RAM, expandable to 16MB of 32-bit memory
- LIM EMS 4.0 driver supplied
- 25 MHz system features Intel 82385 cache controller with 32K 2 way set associative static cache
- 66MB, 25ms Hard Disk (many other sizes available as an option)
- Orchid Prodesigner Plus VGA card. 512K capable of 1024x768 with 16 colors
- NEC Multisync II monitor capable of 1024x768 interlaced
- Socket for Intel 80387 numeric coprocessor
- 1 32-bit, 5 16-bit and 2 8-bit slots
- 1:1 dual hard/floppy controller
- 1.2MB 5.25" floppy drive
- Enhanced 101-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

AVAILABLE OPTIONS

- Full-size vertical case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB
- Numeric coprocessor: 80387
- 20MB to 300MB hard drives with MFM, RLL, ESDI, or SCSI interface
- 40MB - 120MB tape backup drives
- Available in standard monochrome (720x348, amber), standard VGA (640x480, color) or extended VGA (800x600 up to 1024x768, color)
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- 20MB, 48ms hard drive
- Enhanced 102-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 9-pin external monitor output port - EGA
- 150W power supply

AVAILABLE OPTIONS

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by
Neil Rubenking

Lab Notes

WordPerfect Offers a Bona Fide Programming Environment

If you've never thought of yourself as a programmer, you may not have realized that the macros you've been writing for *WordPerfect* 5.0 are really computer programs. When you make use of the advanced macro features in this most popular of word processors, you're actually using a bona fide programming language.

The *WordPerfect* macro programming language (MPL) provides variables, loops, subroutines, conditional branching, and input/output functions. These are the same kinds of programming facilities you'll find both in traditional high-level languages such as BASIC or Pascal and in other application-specific programming languages such as *dBASE*, *Lotus 1-2-3*, and *XyWrite*. With a bit of patience, practice, and a little help from this article, you can master MPL and make *WordPerfect* do things its designers never dreamt of.

The documentation for the advanced macro features supplied with the original release of *WordPerfect* 5.0 was extremely sketchy, however. The November 1988 maintenance release of the manual brought with it a much better description of the advanced MPL instructions. If you still have the earlier manual, you can get the 50-page *Appendix on Advanced Macros* at no additional charge, simply by calling the WordPerfect Orders Department (1-800-321-4566). This document is *essential* for anyone who intends to do serious *WordPerfect* macro programming.

■ The *WordPerfect 5.0* macro programming language brings a powerful new dimension to a favorite word processor.

USING THE MACRO EDITOR

To create a macro program in MPL, you must enter its commands in *WordPerfect*'s macro editor. The macro editor that is currently built into *WordPerfect* 5.0 leaves a good deal to be desired. However, there is a much more powerful, standalone Macro Editor (ME) program. It will let you cut and paste sections of macro code, search and replace, and even print your macros to the printer or to a file. You can get the new ME at minimal cost, either as part of the *WordPerfect Library* or as a separate product. Again, for more information, call the WordPerfect Orders Department.

In the meantime, however, you must make do with the original built-in macro editor. This editor can work only on already-existing macros. To start a new macro, therefore, you must begin by creating an empty one. To do this, hit Ctrl-F10 (the Macro Define key), give the macro a name, and at the "Description" prompt press F1 (Cancel). Next, define the macro again and select option 2, which brings up an Edit screen. From the Edit screen you choose option 2 (Action) again. This is the step that actually puts you into the macro editor itself, so you're now ready to do some programming.

MACRO ELEMENTS

Several different elements can go into a macro program: plain text characters, command keys, macro commands, and control characters. All of these elements except plain text must be surrounded by curly brackets ({, }). While I won't follow the *WordPerfect* manual convention of displaying these bracketed items in boldface type, I will otherwise follow its practice. Macro commands appear in uppercase: {LABEL}, for example. Command keys appear in upper- and lowercase, as in {Line Format}. And control characters have a caret in front of them: {^A}.

To enter plain text in the macro editor, you simply type it. Note that all typed spaces will show up on the screen as midline dot characters (·), which are ASCII character 250. When you execute the macro, any plain text portions are directly inserted into the document on which you are working.

Many *WordPerfect* command keys, such as {Underline} and {Bold}, can be entered into a macro simply by pressing them as usual. Other command keys, however—{Backspace}, {Left}, and {Exit} are examples—become *editing* keys when you're working in the macro editor. There are two ways to tell the macro editor that you want these keystrokes not to edit the macro, but to be inserted into the macro as normal *WordPerfect* commands. For single entries, all you have to do is press Ctrl-V immediately before you hit the command key. If you need to insert an entire series of such command keys, it's easier to use the second method: press Ctrl-F10 and all the keys you subsequently type will appear directly in the macro until you press Ctrl-F10 again.

MACRO COMMANDS

Many commands—{ASSIGN} and {BELL} are examples—are specific to the Macro Programming Language itself. The only way to insert one of these dedicated MPL commands into the body of a macro is to pick it from the macro commands menu, which is shown in Figure 1. Press-

ing Ctrl-PgUp while in the macro editor brings up this menu. Type the first few characters of the name of the command you want; the highlight will jump to that command. Then just hit the Enter key to select the highlighted command. Make sure to add all the arguments you need for the command and take special care to include all necessary tildes. (The section "Tildes" below explains in detail their use in *WordPerfect* macros.)

Since you can't cut and paste within the current macro editor, writing long macros can become *very* tiresome. To make your programming more efficient, you can create Alt-key macros for commonly used constructs. For example, the following three lines make up a macro invoked with Alt-I:

```
{Macro Commands}IF{Enter}{Enter}
{Macro Commands}EL{Enter}{Enter}
{Macro Commands}EN{Enter}{Enter}
```

When Alt-I is pressed, these lines, which form a complete IF..THEN..ELSE structure, are inserted directly into the macro being edited. Note that you need only type in enough of the letters in a command name to distinguish it from others. For example, EL will invoke ELSE, and CHA is sufficient for CHAIN. To select CHAR, however, you must type in CHAR to distinguish it from CHAIN. You should create similar macros for {LABEL}..{RETURN} as well as for any other structures you find yourself using frequently.

CONTROL CHARACTERS

Some commands put a prompt on the screen. You can enhance the value of these prompts through the use of suitable formatting characters. In many cases these formatting characters will be control characters; that is, characters with ASCII values less than 32.

Some control characters can be entered just as you would expect: hold down the Ctrl key and hit the character. However, certain control keys are mapped to *WordPerfect* command keys, so the very act of pressing them *executes* the command. To include these keys in a macro, you must press Ctrl-V before entering them. For safety's sake, I recommend that you *always* press Ctrl-V before pressing *any* control characters—at least until you've learned which ones are also commands. You don't want to be surprised by finding an unexpected {Del to EOL} command inside your macro!

If you use a special keyboard layout, you may have trouble entering control characters in the macro editor. For example, the MACROS.WPK keyboard layout that comes with the *WordPerfect* program takes over ^C, ^D, ^E, and ^G. The easiest workaround for this problem is simply to press Ctrl-6 to restore the original keyboard layout.



Beginning this issue, we will tint *only* successive lines of in-text code that you should enter as one continuous line. As usual, the indentation of any secondary lines indicates the number of spaces you should include when typing multiple lines as a single entry. If a line is not indented, do not include any spaces.

MACRO READABILITY

You can write macros in a number of different styles. For example, so far as *WordPerfect* is concerned, it's perfectly all right to create a macro that consists of one long, continuous line of commands. The macro will work just as well, however, if you format the macro so that you too can read and understand it.

The macro editor lets you press Enter to break a line within the macro without affecting the document itself. Only an {Enter} *code*, produced by pressing Ctrl-V and then Enter, will put a [HRt] in your document. Similarly, pressing the Tab key while in the editor creates a small indent that is unrelated to the document tab settings. Thus, you should indent the lines between a {LABEL} and its {RETURN} or between the elements of an IF ..ELSE..ENDIF structure to make your program more readable. Finally, in addition to formatting your macros to clarify their operation, remember to include *comments* to describe what each part of the program is doing. The macro editor interprets each line that begins with {;} and ends with a tilde (~) as a comment. You should make liberal use of them throughout your macro.

USING VARIABLES IN MPL

Having now examined how the macro editor works, it's time to turn to the programming functions that MPL supports. A program needs some way to store information temporarily. MPL provides ten definable variables, {VAR 0} through {VAR 9}, for this purpose. Since the variables are designated only by numbers, not names, it can be difficult to remember what part each one plays. It's therefore a good idea to summarize your use of each variable in comments at the start of a given program. For example:

```
{;}VAR 3 is "L" for local action
 or "G" for global"
```



Figure 1: Within the macro editor, the Ctrl-PgUp key gives access to the macro commands menu, from which MPL commands like {ASSIGN} and {CALL} can be entered. The {;}comment command allows you to document macro programs.

Lab Notes

You can assign values to variables directly from the keyboard, from a marked block, or with an explicit {ASSIGN} statement. To initialize a variable from the keyboard, you press Ctrl-PgUp (the Macro Commands key), select a number from 0 to 9, and then enter the desired value at the value prompt. Thereafter, pressing Alt-*x*, where *x* is the number of the variable, inserts the value of the variable into your text. Note that you can enter a valid numeric *expression* as the value of a variable and have *WordPerfect* evaluate it for you. You can use this feature as a tiny calculator. If you assign 2+2 to {VAR 1}, for example, when you press Alt-1, 4 will be inserted into your text.

When a block is marked, pressing Ctrl-PgUp assigns the whole block to the variable you choose. There are two limits you must bear in mind when assigning blocks to variables, however. First, each of the ten variables can hold a maximum of 120 characters. If a marked block has more than that, only the first 120 will be stored in the variable. And second, when you capture a block into a variable, most formatting codes will be stripped out or simplified.

In MPL the {ASSIGN} command directly assigns a value to a variable. You can include both ordinary keys and command keys in such an assignment. {CHAR} and {LOOK} assign a single keystroke to a variable, while {TEXT} fills a variable with all the text the user types before he hits the Enter key. (The {CHAR}, {LOOK}, and {TEXT} directives will be discussed more fully in the section "Communication—Input/Output" later in this column.)

Since variables can contain command keys, you can use them as minimacros. As an illustration, consider the code listing shown in Figure 2. VARMAC.WPM is a macro that builds a set of commands in {VAR 3} and then executes them. In this example, the commands in {VAR 3} simply put your name into either a header or a footer. You can use the same interactive technique, however, to build up very complex command sequences.

VARMAC.WPM — **COMPLETE LISTING**

```
{;}VARMAC.WPM demonstrates putting COMMANDS in variables~
{;}=============================================~
{;}{VAR 1} holds users name, entered from keyboard~
{;}{VAR 2} gets choice of header or footer~
{;}The macro builds a command in {VAR 3} and then executes it~

{TEXT}1~What is your name:~
{ASSIGN}3~~
{LABEL}top~
     {CHAR}2~Make a (~]:1. H(^\)eader or a (~])2. F(^\)ooter?~0~
     {CASE}{VAR 2}~
        1~dohead~H~dohead~h~dohead~
        2~dofoot~F~dofoot~f~dofoot~
     ~
     {;}If we reach this spot, it means the user's input
        was not 1, 2, H, h, F, or f~
     {PROMPT}{BELL}Bad input, try again.~
     {WAIT}10~
{GO}top~

{LABEL}good~
     {;}Add the contents of {VAR 1} to the commands
        in {VAR 3}, along with a [HRt] and two
        {Exit} commands.~
     {ASSIGN}3~{VAR 3}{VAR 1}{Enter}{Exit}{Exit}~
     {DISPLAY OFF}
     {VAR 3}
     {DISPLAY ON}
{QUIT}

{LABEL}dohead~
     {;}Put commands to create a header into {VAR 3}~
     {ASSIGN}3~{Format}phap~
{GO}good~

{LABEL}dofoot~
     {;}Put commands to create a footer into {VAR 3}~
     {ASSIGN}3~{Format}pfap~
{GO}good~
```

Figure 2: VARMAC.WPM demonstrates how MPL commands can be inserted into a macro program interactively to build up a complex command sequence.

TILDES

Observe the frequent occurrences of the tilde in Figure 2. In MPL, tildes serve as argument and statement delimiters. Pascal uses commas to separate arguments in function calls and parentheses to enclose an argument list. DOS uses spaces to separate arguments on the command line, and the end of the line serves as the end of the argument list. *WordPerfect*'s MPL uses the tilde for these purposes. For example, {ASSIGN}1~100~ sets the value of variable 1 to 100.

Tildes are also frequently used in pairs in MPL. For example, {ASSIGN}1~~ assigns a null value to variable 1, because there is nothing between the two tildes. A {CASE} statement always ends with two tildes: the first delimits the last selection, and the second ends the entire statement. Similarly, combinations such as

```
{ON NOT FOUND}{GO}somewhere~~
```

need two tildes. The first is for the {ON . . .} statement, and the second is for the {GO} statement. Tildes therefore play a very important role in *WordPerfect* macros. Make sure to keep careful track of them: misplaced or missing tildes will produce errors that are very difficult to find.

VARIABLES ARE CHARACTER STRINGS

There are no "data types" in MPL: its variables are simply strings of characters. However, if a string consists solely of *numeric* characters, you can perform arithmetic operations on it. These operations are subject to the following restrictions:

- The range of allowable numbers is 0 to 65,535. If you enter a larger number, it will be treated as MODULO 65536. (Note: MODULO 65536 is the *remainder* that results when a number larger than 65,536 is divided by 65,536. For example, if you try to assign the number 65,540 to a variable, the number actually stored in the variable will be 4, since 65,540/65,536 leaves a remainder of 4.)
- If a calculation results in a number outside the allowed range, the resulting number will also be treated as MODULO 65536.
- In greater/less comparisons, numbers from 32,768 to 65,535 are treated as *negative*. In order to get the corresponding negative number, you subtract 65,536 from the number. Thus, 65,535 corresponds to 65,535−65,536, which equals −1; 65,534 corresponds to −2, and so on.

Numeric variables in MPL can be used

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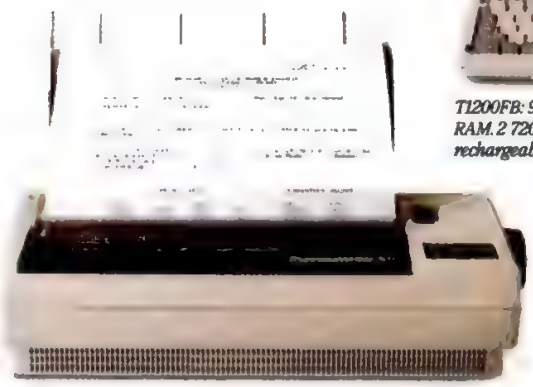
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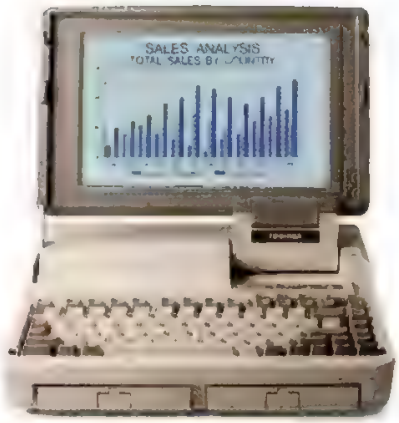


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as TRUE/FALSE (Boolean) values. Zero corresponds to FALSE, 65,535 to TRUE. Thus, if you {ASSIGN} the result of a comparison to a variable, the variable will contain 65,535 if the comparison is true, and 0 if it's false. Note, however, that as a practical matter, *any* positive nonzero numeric value will be treated as TRUE.

The best way to get a feel for the way MPL variables work is to try a few experiments. Use Ctrl-PgUp to assign the value 1000*1000 to {VAR 1}. When you press Alt-1 you'll find that the value stored is 16,960, *not* 1,000,000. That's because 16,960 is the *remainder* that results when 1,000,000 is divided by 65,536. Now press Ctrl-PgUp again and assign 32767>0 to {VAR 1}. This puts the TRUE value, 65,535, into VAR 1, as you would expect. But try using 40000>0. This results in a value of 0, which is FALSE. Why? The reason is that 40,000 is treated as 40,000−65,536, which is −25,536.

EXPRESSIONS

A *WordPerfect* expression consists of an operator and one or two operands. The table in Figure 3 provides a complete list of valid MPL operands. Calculations that involve multiple operators must be broken down into "single operator" steps. For example, to assign 1+2+3 to variable 4, you could do this:

```
{ASSIGN}4~1+2~
{ASSIGN}4~{VAR 4}+3~
```

MPL contains two division operators. The / operator returns the quotient of a division, and the % operator returns the remainder. The +, −, and * operators are the familiar symbols for add, subtract, and multiply. But the & (AND), | (OR), and ! (NOT) operators may be less familiar. These are called "bitwise" operators, because they work on the individual bits that express a number.

To understand bitwise operations, you must consider the operands as strings of binary digits (or bits). The NOT (!) operator works on a single operand, changing a 0-bit into a 1-bit and a 1-bit into a 0-bit. The AND (&) and OR (|) operators take two operands and match the bits in corresponding positions. In an AND operation, the result gets a 1-bit in that position only if *both*

EXPRESSION OPERATORS IN THE WORDPERFECT MACRO LANGUAGE

Numeric Operators

Expression	Operation
!X	Bitwise NOT of the number X. !0 is -1; !65280 is 255.
-X	Negative of the number X. If variable 1 is -10, -{VAR1} is 10. Note: Negative numbers are stored as positive numbers between 32,768 and 65,535.
X+Y	Sum of X and Y. 2+2 is 4.
X-Y	Difference of X and Y. 1989-1 is 1988; 5-6 is -1, which is represented by 65,535.
X*Y	Product of X and Y. 3*4 is 12. Beware of overflowing numeric limits—1000*1000 is 16,960, not 1,000,000.
X/Y	Quotient of X divided by Y. 100/5 is 20; 1/2 is 0.
X%Y	Remainder of X divided by Y. 100%5 is 0; 1/2 is 1.
X&Y	Bitwise AND of X and Y. 62&43 is 42; 127&128 is 0.

```
00111110B (62)        011111111B (127)
& 00101011B (43)      & 100000000B (128)
-----------           ------------
00101010B (42)        000000000B (  0)
```

X|Y	Bitwise OR of X and Y. 62|43 is 63. 127|128 is 255.

```
00111110B (62)        011111111B (127)
| 00101011B (43)      | 100000000B (128)
-----------           ------------
00111111B (63)        111111111B (255)
```

Comparison	Operation
X=Y	TRUE if and only if X and Y are equal.
X!=Y	TRUE if and only if X and Y are not equal.
X>Y	TRUE if and only if X is greater than Y. Note that for comparison purposes numbers from 32,768 to 65,535 are considered negative.
X<Y	TRUE if and only if X is less than Y.

These operators can be used only with numeric operands. Using them with nonnumeric operands will result in the operator being treated as a string. For example, if variable 1 contains 10 and variable 2 contains "ten", {VAR 1}+{VAR 2} will result in the string "10+ten".

String Operators

Expression	Operation
"sX"='sY'	TRUE if and only if string X is identical to string Y. Case is important—"Cat" does not equal "cat".
'sX'!="sY"	TRUE if and only if string X is not identical to string Y.

A string is a series of characters or commands. The only operators for strings are comparison operators. To concatenate two or more strings, simply put them together. For example, {ASSIGN}3~{VAR 1}·and·also {VAR 2}~. Strings used in comparisons must be enclosed in single or double quotes. Either may be used, but the pairs must match.

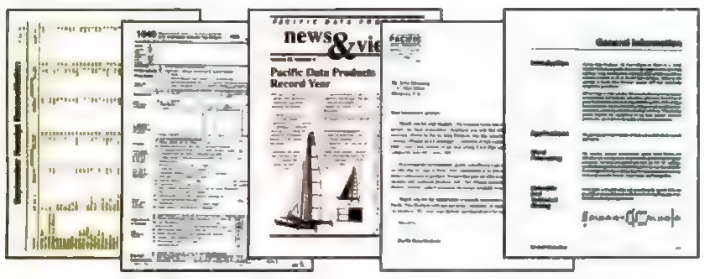
Figure 3: MPL operators permit numeric, bitwise, and Boolean evaluation.



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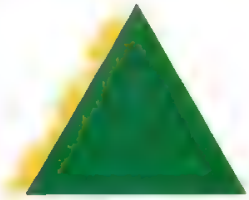
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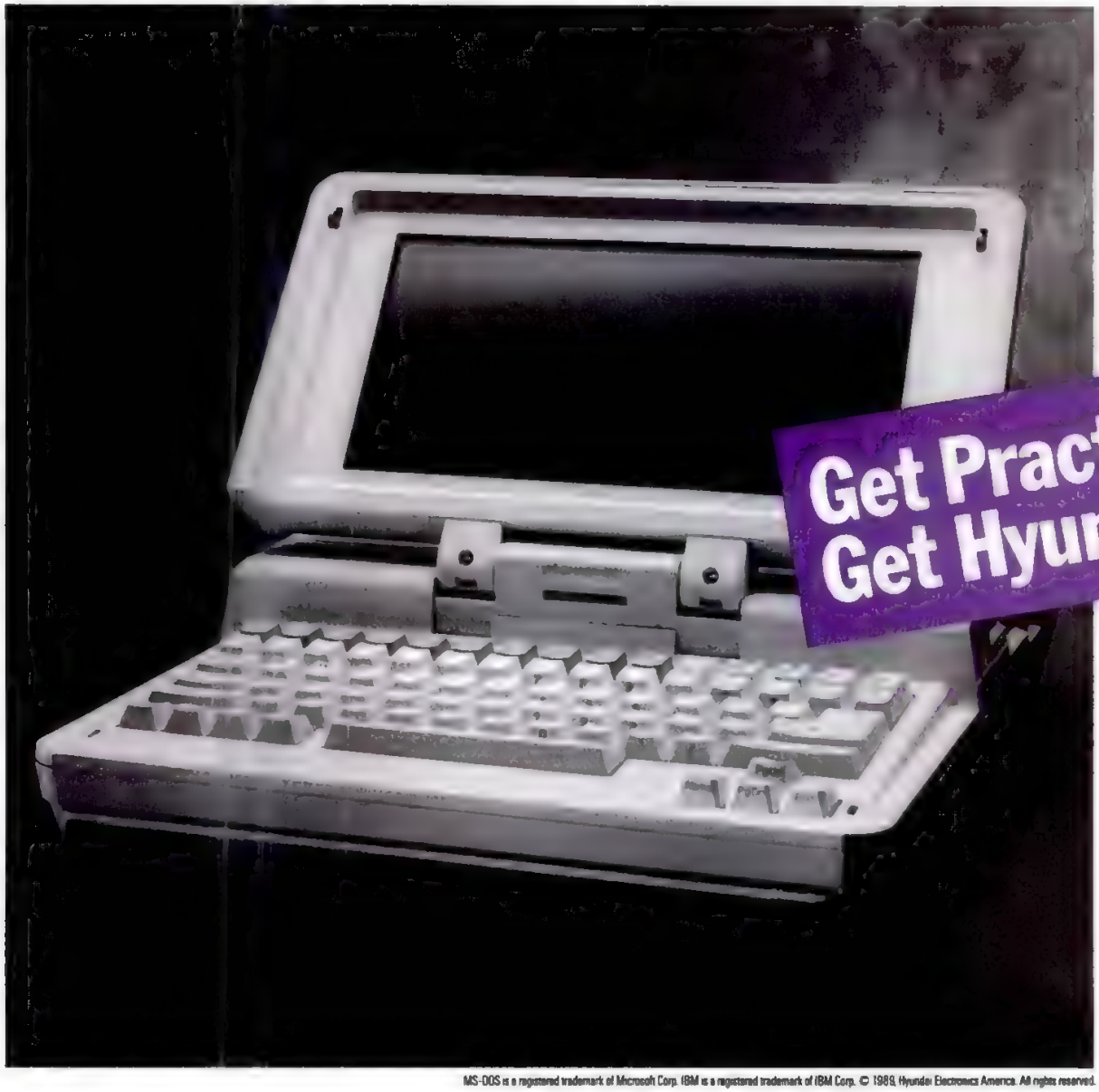
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of the operands are already 1. In an OR operation, the result gets a 1 if *either* operand has a 1; otherwise, the result in that position is a 0.

The bitwise operators have a special relationship with the TRUE and FALSE values. In the TRUE value 65,535, *every* bit is a 1-bit. FALSE is 0, and every one of its bits is a 0-bit. The NOT operator changes TRUE to FALSE and FALSE to TRUE. Using AND on two Boolean values returns TRUE only if both are TRUE. Using OR returns TRUE if either is true. You can use the AND (&) and OR (|) operators to construct complex Boolean expressions. For example, to test if the value of {VAR 1} is between 10 and 20, you could

```
{ASSIGN}2~{VAR 1}>10~
{ASSIGN}3~{VAR 1}<20~
{IF}{VAR 2}&{VAR 3}~. . .
```

What happens in this sequence of operations is either that both {VAR 2} and {VAR 3} will get a value of 65,535, or one of them will get a value of 0. If {VAR 1} is, in fact, greater than 10 and less than 20, then both {VAR 2} and {VAR 3} will receive a value of 65,535 (in other words, every bit will have the value of 1). On the other hand, if {VAR 1} is either less than 10 or greater than 20, then either {VAR 2} or {VAR 3} will receive the value 0. Note that the {IF} statement in the third line will be executed only if both {VAR 2} and {VAR 3} have the value 65,535, for that is the only condition under which the & operator will return TRUE.

STRUCTURED PROGRAMMING

Like the early versions of BASIC, MPL is not intrinsically a structured language. One command simply follows another in sequence, except when the program flow jumps to a {LABEL} elsewhere in a program. If you took a printout of this and penciled in lines connecting each {LABEL} statement with the commands that jump to it, your printout would end up looking like spaghetti. In fact, the programmer's term for a highly unstructured program is "spaghetti code."

The problem with unstructured programs is that we humans find it hard to follow what the program is doing. And understanding each step in the program is essential if you have to debug or modify it

DEMO.WPM — COMPLETE LISTING

```
{;}DEMO.WPM·--·demonstrates·several·concepts·in·WordPerfect
     macro·programming.~
{;}=============================================================~
{;}SECTION·1·--·Using·display·attributes·in·prompts~

{;}Build·a·row·of·*'s·in·VAR·1·and·a·horizontal·line·in·VAR·2~
{ASSIGN}1~********~
{ASSIGN}1~{VAR 1}{VAR 1}{VAR 1}{VAR 1}~
{ASSIGN}1~{VAR 1}{VAR 1}~
{ASSIGN}2~————————~
{ASSIGN}2~{VAR 2}{VAR 2}{VAR 2}{VAR 2}~
{ASSIGN}2~{VAR 2}{VAR 2}~
{PROMPT}
{^R}{Home}
Do·you·like·these·colors?··{^N}{^P}YES!{^O}{^P}·(no)
{^Q}
{;}The·lines·below·contain·various·types·of·display·formatting
     codes.··Consult·the·macro·programming·Appendix·for·a
     detailed·description·of·these·codes.··Note·that·some
     of·the·control·characters,·specifically·those·from·{^H}
     to·{^L},·are·displayed·as·command·codes.~
{^P}{^E}{^E}{^N}{^E}                  ┌{VAR 2}┐{^Q}
{^P}{^E}{^F}{^N}{^E}                  │{^Q}·{^N}{^A}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{^G}{^N}{^E}                  │{^Q}·{^N}{^B}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{Home}{^N}{^E}                │{^Q}·{^N}{^G}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{Tab}{^N}{^E}                 │{^Q}·{^N}{^D}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{Enter}{^N}{^E}               │{^Q}·{^N}{^C}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{Del to EOL}{^N}{^E}          │{^Q}·{^N}{Del to EOL}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{Del to EOP}{^N}{^E}          │{^Q}·{^N}{Enter}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{^M}{^N}{^E}                  │{^Q}·{^N}{^M}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{^N}{^N}{^E}                  │{^Q}·{^N}{^O}{VAR1}{^Q}·{^N}{^E}│{^Q}
{^P}{^E}{^O}{^N}{^E}                  └{VAR 2}┘{^Q}

{;}SECTION·2·--·User·input·with·default·value·"Y"~
{CHAR}1~~
{DISPLAY OFF}{DISPLAY ON}
{IF}"{VAR 1}"='n'~                    {;}If·the·user·entered·small-n...~
     {ASSIGN}1~N~                     {;}...·make·it·a·capital·N.~
{END IF}
{IF}"{VAR 1}"!='N'~                   {;}If·the·user·entered·ANYTHING·but..~
     {ASSIGN}1~Y~                     {;}N,·make·it·a·Y.~
{END IF}

{IF}'{VAR 1}'="Y"~
     {ASSIGN}2~GREAT!~
{ELSE}
     {ASSIGN}2~TOUGH!~
{END IF}

{;}SECTION·3·--·Using·{LOOK}·to·create·a·loop·that
     continues·until·the·user·presses·a·key~
{LABEL}loop~
     {PROMPT}
          {;}Turn·on·the·superscript·attribute·(red·on·cyan)·and
             display·a·message~
          {^Q}{^N}{^E}
          {^P}#{Del to EOL}
          {^P}#{Del to EOP}          ·{VAR 2}·
          {^P}#{^N}
     ~
     {WAIT}2~
     {PROMPT}
          {;}Turn·OFF·the·superscript·attribute·and·display
             the·same·message·--·produces·a·flashing·effect.~
          {^O}{^E}{^]}
          {^P}#{Del to EOL}
          {^P}#{Del to EOP}          ·{VAR 2}·
          {^P}#{^N}
     ~
     {WAIT}2~
     {;}If·the·user·pressed·a·key,·exit·the·loop.~
     {LOOK}3~
     {IF EXISTS}3~
          {GO}end~
     {END IF}
{GO}loop~
{LABEL}end~
{DISPLAY OFF}{DISPLAY ON}
```

Figure 4: The first section of this code listing produces the multicolor display seen in Figure 5. The second section shows how to provide a default for misentered user input, and the third section illustrates a program loop that can be broken by pressing a key.

You know exactly what your company wants in a color printer.

later. Thus, even as you write the program, it's worth the effort to structure your code so as to be intelligible later. Since you can write well-structured programs in MPL just as you can in BASIC, there's no excuse not to do so.

The most powerful structural element in your MPL macros is the *subroutine*. A subroutine is simply a series of macro commands that begins with a {LABEL} and ends with a {RETURN}. The macro *calls* a subroutine via a {CALL} statement. At this point program control is transferred to the line immediately following the label. When command execution reaches the {RETURN} statement, control returns to the line immediately following {CALL}.

You can {CALL} the same subroutine from within your program as many times as you want. Remember to be generous with comments, however, so you can trace what is *supposed* to happen in your subroutines. Note, too, that you should never just {GO} to a subroutine label. If no {CALL} is active, the execution of your macro will end at the {RETURN} instruction.

There *is* a use, however, for blocks of code that begin with a {LABEL} and end with a {GO}. These are similar to subroutines except that when they're finished they always {GO} to the same spot. If that spot is the original {LABEL}, you have the equivalent of a program loop.

When working with loops, the one thing you must always be sure to include is a way out of them.

When working with loops, the one thing you must always be sure to include is a way out of them—you don't want your macro to loop forever. Section 3 of the DEMO.WPM macro code, shown in Figure 4, keeps looping until you press a key.

Finally, there are sections of code in which another {LABEL} appears before either a {RETURN} or a {GO}. That sounds innocent enough—until you try to trace the flow of commands within the macro. If there are three or four labels above a particular line, with no intervening {RETURN} or {GO}, you can't tell how you reached that line. Thus, try to avoid this type of programming whenever possible, especially in macros that occupy more than one screenful of code.

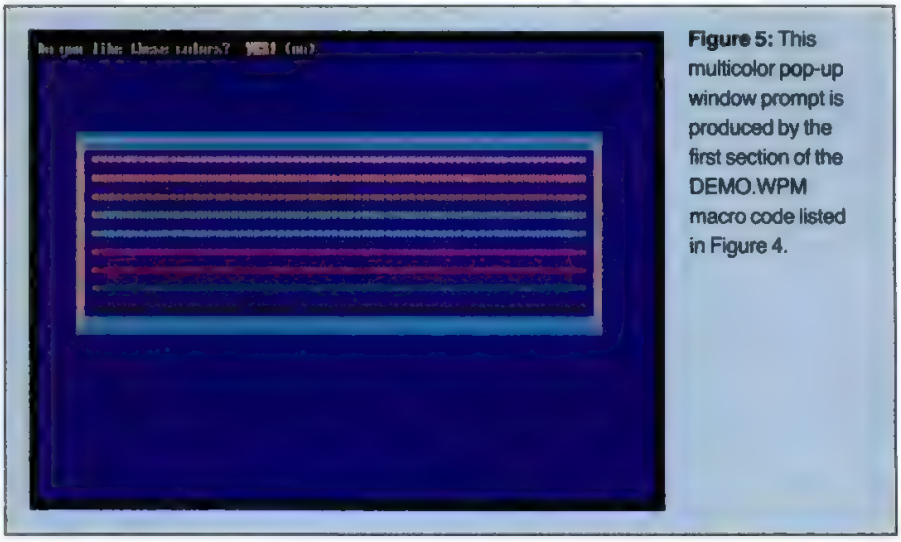


Figure 5: This multicolor pop-up window prompt is produced by the first section of the DEMO.WPM macro code listed in Figure 4.

The program flow commands mentioned so far work *within a single macro*. MPL provides another level of flow control designed to work between different macros. There are two ways to implement this level. First, you can *chain* to another macro using the {CHAIN} command. This transfers control unconditionally to the new macro when the current macro ends. If you want to chain to another macro immediately, you must follow your {CHAIN} command with a {RETURN}. Second, you can {NEST} a macro call, regaining control when the nested macro finishes. {CHAIN} behaves like a {GO} statement, whereas {NEST} is like {CALL}. Note that {NEST} and {CALL} share a total limit of 20 levels. Each {CALL} uses up one level; each {NEST} uses two.

MAKING DECISIONS: THE IF STATEMENT

If it looks like rain, take an umbrella; otherwise, take your sunglasses. Programming languages have a similar need to make such conditional decisions, and MPL provides a standard IF..ELSE ..ENDIF construct for just that purpose. It begins with an {IF} statement followed by an expression. If the expression evaluates as TRUE (that is, if it contains the value 65,535 or, actually, any positive nonzero numeric value) then the lines between {IF} and {ELSE} are executed. If it is FALSE (the expression evaluates to 0), then the lines between {ELSE} and {END IF} are executed instead. MPL also includes an {IF EXISTS} test, which is used to determine whether a given variable actually contains a specified value.

To make your {IF}s and nested {IF}s easier to read, remember to indent the lines between {IF} and {ELSE} and those between {ELSE} and {END IF}, just as I suggested that you do with subroutines earlier. For example,

```
{IF}{VAR 1}>=5~
  {IF}{VAR 1}<=10~
    {;}It is between 5 and 10~
  {ELSE}
    {;}It is greater than 10~
  {END IF}
{ELSE}
  {;}It is less than 5~
{END IF}
```

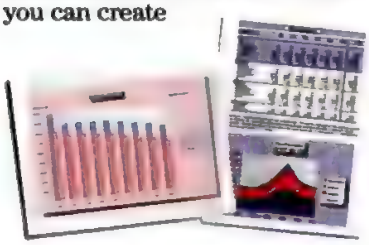
An {IF} statement is like a yes/no question; a {CASE} statement is like multiple-choice. The {CASE} statement compares its selector variable with a series of values, each followed by a label name. If there's a match, control transfers to the associated label. If there isn't a match, control just goes on to the line following the {CASE}. Unlike similar statements in other languages, however, in MPL you can't specify a *range* of values, such as "A to Z" or "100 to 200." If you need to test for a range of values, you must use a set of {IF} tests, not {CASE} statements. {CASE CALL} is similar to {CASE}, but all of the target labels *must be subroutines*. After the

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CIRCLE 326 ON READER SERVICE CARD

chosen subroutine ends, control picks up again at the line following the {CASE CALL} statement.

EVENT-HANDLING COMMANDS

Most of the execution of an MPL program is *linear*: from one instruction it either proceeds to the next in sequence or jumps to a specified label. Event-handling commands are nonlinear; they can take control at any time. The {ON ERROR} directive, for example, specifies the action to be taken if an error occurs during macro execution. Similarly, {ON CANCEL} tells the program what to do if the user presses the F1 (Cancel) key. And {ON NOT FOUND} determines what is to happen when a search fails.

There are only two basic ways the MPL program can react to such events: either by jumping or by quitting. Therefore, on the one hand, you can set your program to {CALL} or to {GO} to a label, or {RETURN}. Or, on the other hand, you can set your program to {BREAK}, {QUIT}, and {RESTART}.

As an alternative to specifying a plain-vanilla {RETURN}, you can use one of three special commands: {RETURN ERROR}, {RETURN CANCEL}, or {RETURN NOT FOUND}. Of these, the {ON NOT FOUND} command is probably the most commonly used. Suppose, for example, that you want to set up a loop that will search for each occurrence of a given string, perform some action when it finds the string, and stop when there are no more occurrences. Put this statement

```
{ON NOT FOUND}{GO}outofLoop~~
```

before the loop, and a

```
{LABEL}outofLoop~
```

immediately following the code that makes up the loop. If the failure of a particular search is a fatal error for your macro, try using

```
{ON NOT FOUND}{RETURN ERROR}~
```

If you press F1 (the Cancel key) in the middle of a macro, the results are highly unpredictable. There are many kinds of operations a macro may have started that may not have been completed. The display may be off, for example, or the "Block On" state may be active.

A possible solution is to attempt to clean up the mess with an

```
{ON CANCEL}{GO}cleanup~~
```

command. At the label "cleanup," you would turn the display on and check the {STATE} variable (described below) to see whether or not you need to turn off a marked block. A routine to exit gracefully upon macro cancellation can be as simple or complex as you choose to make it.

COMMUNICATION—INPUT/OUTPUT

It's a simple matter to "output" text to your current document. You just insert the text directly into the macro. Within a macro, if you want to output the contents of variable *n*, you must place a {VAR *n*} statement into the macro by pressing Alt-V followed by Ctrl-*n*. To read data from the document on the screen, block the desired portion and assign it to a variable. For example, to read the character at the cursor into {VAR 1}, you would hit the keystroke sequence: Ctrl-F4, Right (one character), Ctrl-PgUp, 1.

MPL provides several ways of handling keyboard input. The {TEXT} command fills a variable with a line of text input by the user. The {CHAR} command waits for the next character from the keyboard and stores it in a variable. {LOOK} grabs a key *if* the user has pressed one, but doesn't wait. Section 3 of the demonstration macro listed in Figure 4 shows how to create a

DETERMINING WORDPERFECT'S WORKING CONDITIONS

Bit	Value	Meaning
0	1	Currently in document 1
1	2	Currently in document 2
2	4	In main editing screen
3	8	In editing structure other than main (for example, header, footnote)
4	16	Macro definition active
5	32	Macro execution active (always on)
6	64	Merge active
7	128	Block active
8	256	Typeover active
9	512	Reveal codes active
10	1,024	Yes/No question active

Figure 7: The bit values in the {STATE} variable correspond to different active conditions within the program. Multiple conditions are reported by summing the bit values.

MOVEONLY.WPM — COMPLETE LISTING

```
{;}MOVEONLY.WPM·--·allows·only·cursor·movement·keys~
{;}=============================================~
{;}You·can·use·a·"filter"·like·this·instead·of·a·{PAUSE}.
     It·accepts·ONLY·cursor·positioning·keys·until·you
     press·{Enter}.~

{LABEL}Another·Key~
     {CHAR}1~~
     {CASE}{VAR 1}~
        {Left}~ok~{Right}~ok~{Up}~ok~{Down}~ok~
        {Home}~ok~{End}~ok~{Page Up}~ok~{Page Down}~ok~
        {Screen Down}~ok~{Screen Up}~ok~
        {Enter}~end~
     ~

{BELL}
{GO}Another·key~

{;}If·the·key·in·{VAR·1}·is·"ok",·execute·it.~
{LABEL}ok~{VAR 1}{GO}Another·key~
{LABEL}end~
```

Figure 6: MOVEONLY.WPM demonstrates the construction of an input "filter" that produces only error beeps for all but specified user keystrokes (in this case, the cursor positioning keys).

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☐ 386 systems
☐ Peripherals
☐ Other

B. Are you an:
☐ End user
☐ Consultant
☐ Reseller
☐ Corporate purchaser
☐ DP/MIS
☐ Owner

C. How many business PCs do you now have installed?
☐ 1-10
☐ 11-25
☐ Over 25

D. How many PCs does your company plan to purchase in the next 12 months?
☐ 1-10
☐ 11-25
☐ Over 25

E. What is your primary computing interest?
☐ Corporate/Institutional
☐ Small business
☐ Student/Educational
☐ Home

3021

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☐ Other

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☐ Consultant
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☐ DP/MIS
☐ Owner

C. How many business PCs do you now have installed?
☐ 1-10
☐ 11-25
☐ Over 25

D. How many PCs does your company plan to purchase in the next 12 months?
☐ 1-10
☐ 11-25
☐ Over 25

E. What is your primary computing interest?
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"repeat until key pressed" loop using {LOOK}. Note also how the macro code uses *WordPerfect*'s Superscript and Subscript features to create a flashing (or blinking) effect in its final message to the user.

Any of these commands can place a prompt on the bottom line of the screen, such as

```
Delete this file? (Y/N) Yes.
```

The prompt may actually extend to several lines, and by using advanced formatting commands, you can make it into a pop-up window. Parts of the prompt can be reverse video, high-intensity, or blinking, or have a number of other attributes. Section 1 of the DEMO.WPM macro (see Figure 4) provides the code for creating the multicolor pop-up window prompt shown in the screen display pictured in Figure 5.

When writing an advanced macro that accepts user input, it's wise to follow *WordPerfect*'s example and set up a default value. If the user is asked to enter Y or N, for example, and you provide a default of Y, then *any* keystroke other than n or N will be interpreted as a Y. To implement this kind of default, you must include two tests in your program. First, test to see if the user entered a lowercase n; if so, convert it to N. Then test to see if a capital N was entered. If not, convert it to Y. Section 2 of the DEMO macro in Figure 4 implements this technique.

You can insert a {PAUSE} for user input at almost any point in a macro. You might, for example, display the List Files screen and tell the user to highlight the desired file and hit Enter. Bear in mind, however, that incorporating the {PAUSE} command has its dangers. In this example, the user could type *any* key (except Enter) while in the paused state. He might even leave the List Files screen before hitting Enter, and this would raise havoc with your macro.

There's a way around such problems, of course, but you'll have to spend some programming time in order to work it out. A safer alternative to using the {PAUSE} statement is to process user input through a filter that only allows certain keystrokes. MOVEONLY.WPM, the macro that is shown in Figure 6, provides a model. It reads each key the user types, but executes only cursor positioning keys. All of the other keys produce a beep.

THE {STATE} VARIABLE

The {STATE} variable provides information on the *WordPerfect* environment at any given moment. Each bit in the number reported by {STATE} corresponds to a particular condition, and the table in Figure 7 shows the meaning of these bits. If bit 0, which has a value of 1, is current, document 1 is current. If bit 9 with a value of 512 is set, the Reveal Codes mode is active. The value of {STATE} is the *sum* of all the active states.

To determine whether an individual state is set, use the AND operator on {STATE} and the number of the state you want to check. If the result is nonzero, the state is active. For example, to test whether Block mode is active you would use

```
{IF}{STATE}&128~
```

(Remember, again, that any positive nonzero numeric value will indicate a value of TRUE in an {IF} test.)

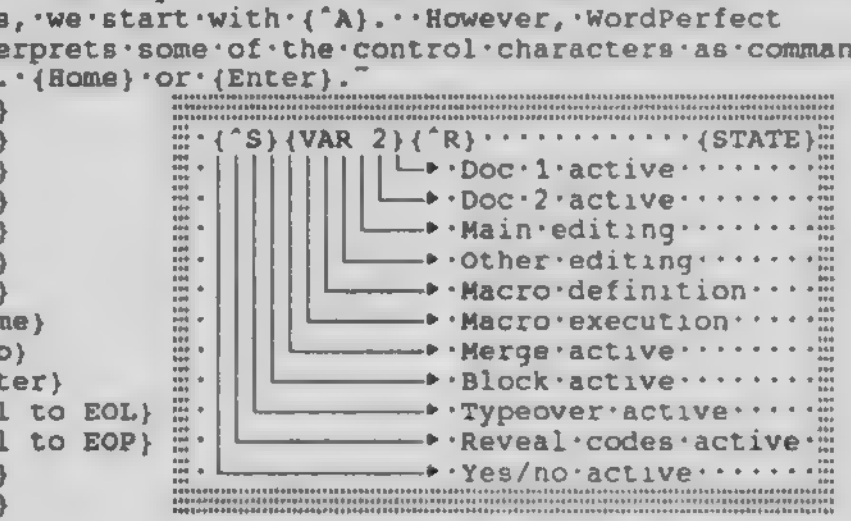
Why bother obtaining the state information? For one thing, a macro that marks a block will fail if Block Mode is already active. Thus, the Block Mode needs to be turned off before that part of the macro program is executed. Similarly, if a macro is designed to work *only* on a marked block, it should halt with a warning if in fact no block is marked. If a macro saves the current file, it can test whether a yes/no question comes up after the {SAVE}. If

STATE.WPM — **COMPLETE LISTING**

```
{;}STATE·macro·--·displays·value·of·{STATE}·variable~
{;}=============================================~
{;}{VAR·1}·is·used·to·"count·down"·from·1024·to·0,
     halving·its·value·with·each·repetition.~
{;}{VAR·2}·accumulates·a·kind·of·binary·string·that
     corresponds·to·{STATE}·--·a·space·for·a·zero·bit,
     a·block·for·a·one·bit~
{;}To·create·the·special·characters·in·this·macro,·hold
     down·the·ALT·key,·tap·out·the·ASCII·number·on·the·numeric
     keypad,·and·then·release·the·ALT·key.~

{ASSIGN}2~~              {;}Clear·variable·2~
{ASSIGN}1~1024~          {;}Set·to·highest·bit-value·of·{STATE}~
{LABEL}loop~
     {IF}{STATE}&{VAR 1}~      {;}IF·the·bit·is·set,~
        {ASSIGN}2~{VAR 2}■~    {;}··add·a·block·to·VAR·2~
                               {;}block·is·ASCII·254~
     {ELSE}
        {ASSIGN}2~{VAR 2}·~    {;}If·not,·add·a·space~
     {END IF}
     {ASSIGN}1~{VAR 1}/2~      {;}get·next·lower·bit-value~
     {IF}{VAR 1}=0~            {;}continue··til·0~
        {GO}done~
     {END IF}
{GO}loop~
{LABEL}done~

{PROMPT}{^R}
     {;}The·display·uses·the·following·ASCII·characters:~
     {;}···▒=176···|=179···─=196···└=192···►=16~
     {;}{^P}·is·a·cursor·positioning·command.··The·{^E}·in
        each·line·says·to·start·in·the·fifth·column.··For·the
        rows,·we·start·with·{^A}.··However,·WordPerfect
        interprets·some·of·the·control·characters·as·commands,
        e.g.·{Home}·or·{Enter}.~
{^P}{^E}{^A}
{^P}{^E}{^B}
{^P}{^E}{^C}
{^P}{^E}{^D}
{^P}{^E}{^E}
{^P}{^E}{^F}
{^P}{^E}{^G}
{^P}{^E}{Home}
{^P}{^E}{Tab}
{^P}{^E}{Enter}
{^P}{^E}{Del to EOL}
{^P}{^E}{Del to EOP}
{^P}{^E}{^M}
{^P}{^E}{^N}
{^S}
~
```




```
{CHAR}9~~                        {;}wait·for·a·keypress~
{DISPLAY OFF}{DISPLAY ON}        {;}restore·the·display~
```

Figure 8: STATE.WPM reports the conditions under which *WordPerfect* is currently operating. These must often be tested and correctly set before macro program operations can be executed reliably.

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IQ Engineering Super Cartridge 2
June 13, 1989

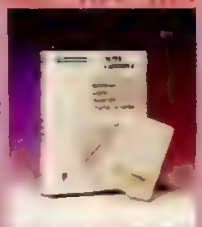
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Lab Notes



Figure 9: Running the STATE.WPM listed in Figure 8 reports the current WP environment as an overlay on the macro editor screen.

not, the user must name the file. Figure 8 lists the code for STATE.WPM, which illustrates {STATE} usage. It displays the current state, as seen in Figure 9. Try it—get into a header definition, or turn on typeover, or turn on block. Now run STATE.WPM and see which bits are set.

DEBUGGING TECHNIQUES

Debugging *WordPerfect* macro programs can be an amazingly difficult task. The macro editor doesn't check your syntax; it just attempts to execute the commands as you've entered them, willy-nilly. One missing tilde is enough to crash an entire macro program. A macro with a problem in the programming syntax will usually just stop dead, sometimes with a "*Please Wait*" message stuck on the screen. You get no helpful error messages or signals.

If you're having trouble getting a macro program to work, a good way to start tracking down the problem is to watch the macro run, step by step, by invoking {STEP ON}.

If you're having trouble getting a macro program to work, a good way to start tracking down the problem is to watch the macro run, step by step, by invoking the {STEP ON} command. This causes *WordPerfect* to execute your program one command at a time, and produces an enigmatic message describing each command. You'll need the up-to-date "Appendix on Advanced Macros" to interpret these messages. At the end of the suspect area you can get back to normal execution with {STEP OFF}.

Sometimes, when you have no idea where the problem is, stepping through the entire MPL macro is simply too long a process to be feasible. In such a situation, you can borrow some debugging tricks from other languages. First, there's the venerable technique of writing notes to the screen. You can insert lines of text in your macro such as

```
{Enter}Reached label
GetName{Enter}
```

While including such lines will produce an unsightly screen display, they can help you locate the point at which your macro is failing.

For a more sophisticated approach, you can write these messages to a file. Insert an appropriate message into the text, mark it as a block, and append it to your debugging file. Appending turns off the marked

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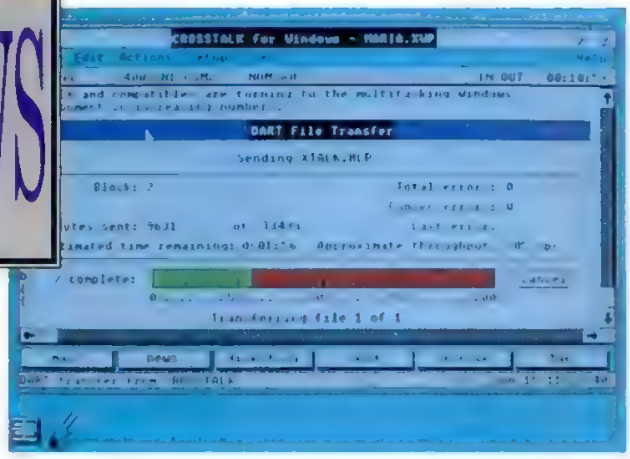
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block, so mark the same block again with

```
{Block}{Goto}{Goto}
```

Then delete the message.

If the program that you are writing doesn't require keeping {DISPLAY OFF}, you can display messages to yourself with {CHAR} statements. Just pick an unused variable, say {VAR 9}, and then insert lines such as

```
{CHAR}9"Just past label "loop""
```

Either leave {DISPLAY ON} or turn it on just before the {CHAR} statement and then turn it off just afterwards.

Some programs will literally show their faults if you run them in slow motion. The {SPEED}## command allows you to slow down operations by inserting a delay

You may want to leave "debugging hooks" in your program, even after it is complete and checked out.

after each macro command. If you don't need a pause after *every* command, try putting a {WAIT}## statement after certain commands. {SPEED}~ sets a delay of ##/100 seconds (hundreths of a second) between commands; {WAIT}~ inserts a one-time delay of ##/10 seconds (tenths of a second).

Even when your program is complete and thoroughly checked out, you may still want to leave some "debugging hooks" in place. Rather than delete the debugging statements you've inserted, you can surround them with a condition such as

```
{IF}"{VAR 9}"="DEBUG"~
```

Then, if you later find yourself getting into trouble—as, perhaps, when you go back and make modifications to the macro, you can easily switch into "debugging mode."

GO FORTH AND PROGRAM!

Release 5.0 of *WordPerfect* is release 1.0 of the Macro Programming Language. Being a completely new product, it may not have every feature we would like. Syntax checking would be nice, and a cut-and-paste capability in the macro editor would certainly be appreciated. Especially convenient would be the ability to convert macro programs to a text or document file for study or printing.

Nevertheless, even the current version of MPL is a functional programming language. And now that you've realized you're a programmer after all, you should feel no trepidation about exploring all its possibilities. With a little help from you *WordPerfect* can more nearly live up to its name. ■

Neil J. Rubenking is a contributing editor of PC Magazine.

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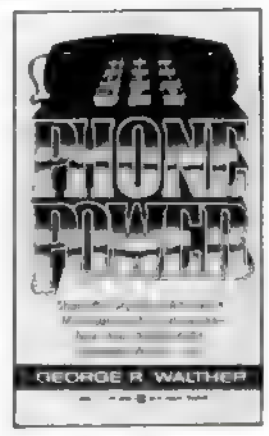
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by
Ron Q. Smith

Utilities

Create Colorful, Interactive Menus for Your Applications

Batch files let you automate many routine tasks, as everyone who has written or modified even his AUTOEXEC.BAT file knows. But when you need to write batch files to automate routine work procedures for computer novices, you immediately hit a problem. What the user needs is a straightforward task menu with fill-in-the-blank options. Unfortunately, the DOS batch file language provides no way to handle the input from a user's keyboard.

MENU was created to solve this problem. MENU lets you display an unlimited amount of information with which the user can interact. The relevant keyboard input and constant data from the screen are then passed through a controlling *template* file and are then used to write a batch file (or another program input file) on the fly. And by running the whole process under a simple batch file, you can make the procedure seamless and transparent to the user.

Use MENU's screen editing facilities to create the displays, to see exactly what the user will. Screen files can be as long as 300 lines and may include up to 100 input fields of any length. MENU also supports full customization of the display/input screen: any character position may be associated with any of the standard video attributes. Use your favorite ASCII text editor to create the template file that gives the format of the output files.

■ Here's how to provide novice users with all the screen displays and keyboard input facilities they need to operate.

GETTING MENU

You can get a ready-to-run copy of MENU.COM from PC MagNet, as explained in the sidebar "MENU by Modem." Alternatively, you can create the .COM file either from the MENU.ASM source code or from MENU.BAS, which are available via PC MagNet.

Because of space considerations, we can't print the source code here. However, you can get a listing of both the assembly and BASIC listings by mail or fax by sending a written request with your name and address (or fax number) to Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016; Attention: Carolyn Falconer. (Note: estimated fax length is 50 pages.) No phone calls, please.

To create MENU.COM from MENU.ASM, you must have a macro assembler (IBM or Microsoft, Version 2 or later) and enter the following command sequence:

```
MASM MENU;
LINK MENU;
EXE2BIN MENU MENU.COM
DEL MENU.OBJ
DEL MENU.EXE
```

If you don't have a macro assembler, you can generate the same .COM file simply by running MENU.BAS in BASIC.

The MENU command syntax is

```
MENU [/D/E/N] screen template
  out1 [out2...  outn]
```

Each of the italicized operands is the name of a file and may include a drive and full path specification. A *screen* file is normally created by using MENU with its /E (Edit) option. Entering the line

```
MENU /E ,,screen
```

will create a new file to be stored under the filename SCREEN. *Note the use of the two commas*. MENU normally expects to work with at least three filenames. In this case, there is no input screen file (you're creating it), and there is no template file to control the generation of an output file. The commas take the place of the missing operands. If you subsequently need to edit SCREEN (of course, screen files need not have this filename), entering

```
MENU /E screen,,screen
```

will let you update the file and save it under its original name.

While you won't usually have to deal with one outside the MENU editor, a screen file is an ASCII file that contains the characters to be displayed, ANSI video control sequences, and other special characters. Figure 1 contains a description of ASCII characters used on a screen.

It is the *template* file that determines the output files. A template file is also an ASCII file, and it can be created with a text editor such as the *PC Magazine* utility TED. It contains any text that you want to put in the output files, plus instructions about which information from the display you want copied to the output files. You may copy all or part of an input field. You may also copy constant data fields from the display to the output files. Each input or constant field can itself be anywhere from a single character to many lines in length.

A few special characters are recognized in a template file to control copying from the display and to select among the output files. All other characters are copied with-

SPECIAL SYMBOLS USED IN MENU

Character	Description
\	Put the next character in the display even if it is a control character. This allows [,], {, }, \, and ESC to be included.
[	Start of an input field. The position in the display is saved.
]	End of input field. The previous position in the display is saved as the end of the input field. Any characters between the [and] are displayed as a default value for the input field.
{	Start of constant field. The position in the display is saved.
}	End of constant field. The previous position in the display is saved as the end of the constant field. Characters between the { and } are the constant. Constant fields may be copied to the output files by using the {*nnn*} or {[*nnn*]} template patterns. They are a convenient way of associating multiple characters with a menu selection. Although constant fields take up space in the display, they need not be visible if the appropriate video attributes are used.
ESC	Start of ANSI video attribute sequence. Subsequent characters are scanned until the terminating m and the ANSI.SYS attributes are applied. The Set Graphics Rendition (SGR) functions are supported. All of these have the pattern ESC[#;...;#m, where ESC is the ASCII control character 27 and # is any decimal value listed below:

Value	Description
0	All attributes off (normal white on black)
1	Bold on (high intensity)
4	Underscore (monochrome only)
5	Blink
7	Reverse video — reverses whatever colors are already in effect
8	Canceled on (invisible) — foreground color is set equal to background color
30	Black foreground
31	Red foreground
32	Green foreground
33	Yellow (brown) foreground
34	Blue foreground
35	Magenta foreground
36	Cyan foreground
37	White foreground
40	Black background
41	Red background
42	Green background
43	Yellow (brown) background
44	Blue background
45	Magenta background
46	Cyan background
47	White background

In addition to the characters above, CR and LF also have special meaning within a file. Normally created using MENU /E, a screen file is an ASCII file in which each record occupies one or more lines on the display. Long records wrap around the display at the current line width of the display. Whenever a carriage return (CR) or line feed (LF) character is encountered, the display line is filled out with blanks. A CR-LF sequence is treated as a single CR character.

Figure 1: The MENU utility uses the ASCII characters that are shown above in order to define fields and control screen attributes.

out change. The simplest way to create a template file is to start with a sample of the file you want to create. You would edit that file, replacing variable information with references to the display. For example, you would replace a filename in your sample with [3] to cause the contents of the third input field displayed to be copied to that position in the output file. See the sidebar "How to Create a Template File" for a complete discussion of the control characters used in template files.

The *out* operands are the names you give to the output files MENU generates. Typically you will need only a single output file (and typically it will have a .BAT extension), but you may use as many as you can fit (up to 64) on the DOS command line.

Note: Since the screen file, template file, and all output files are open at the same time, you must make sure that the FILES= statement in your CONFIG.SYS permits the maximum number of files that you will need. To use five output files, for example, you would need to have FILES=12, since DOS always ties up five for its own use. If you should ever need to generate more than 13 output files (FILES=21), you will also need DOS 3.3 or later and a utility that expands the number of handles available for each process.

The /D, /E, and /N command-line switches may appear anywhere after MENU and provide additional control over its operation. The /E option has been discussed above. Entering

```
MENU /D filename
```

turns MENU into a full-screen display utility. This is a convenient way to display the contents of another file, up to 300 lines. ANSI color sequences in the file will be interpreted, but other screen file special characters, such as [,], {, }, and \ will simply be displayed. In display mode, you can use the cursor-control keys to scroll through the file, but you can't make any changes or create any output files.

Normally, MENU saves a copy of the console screen before it starts to work. The original screen is then restored when MENU is through. You may combine the /N (No-restore) option with any of the other uses of MENU to inhibit saving and restoring the display screen contents. This avoids a lot of screen flashing if you are linking from one menu to another menu or to a program that paints the entire screen on its own.

USING MENU

Let's assume that you want to create the batch file TASK.BAT, which will let the user execute one of several programs using a specified input file. You need to give the user a choice of program names or a simple selection code and you must let him enter the name of an input file. In DOS 3.3 or later, a suitable batch file is

```
@MENU SEL.MNU SEL.TPL SEL.BAT
@CALL SEL.BAT
@DEL SEL.BAT
```

If you have an earlier version of DOS, your batch file will look like this:

```
ECHO OFF
MENU SEL.MNU SEL.TPL SEL.BAT
SEL.BAT
```

You create SEL.MNU using

```
MENU /E ,,SEL.MNU
```

When MENU executes, you will see a blank screen except for the status line at the bottom. Use the cursor-control keys and the function keys, shown in Figures 2 and 3, to set up the display as you prefer. Be sure to use the F7 and F8 keys to define the start and end of the two input fields and F2 to define the end of the display. You may also use F9 and F10 to set display colors.

MENU'S FUNCTION KEYS

Key	Description
F1	Help (displays key definitions)
F2	Set end of menu
F3	Display input and constant-field definitions
F4	Delete an input or constant-field definition
F5	Start of constant field
F6	End of constant field
F7	Start of input field
F8	End of input field
F9	Change display attribute
F10	Apply display attribute to current cursor position

Figure 2: These perform many functions that help you edit and create files in MENU.

Then press Ctrl-Enter to exit MENU and create the SEL.MNU file. (Until you learn the program, you'll find yourself referring back to Figures 1, 2 and 3 with some frequency!)

The screen you've created might look like that shown in Figure 4. Now, use your text editor to create SEL.TPL. This should look like Figure 5, only with real program names substituted for the WPROC, PERT, SPREAD, and DBA shown. You may want to add the /N option to MENU in your TASK.BAT file if the programs paint their own first screen.

TASK.BAT is now ready to run. The user enters the number of the task at the appropriate location, hits Enter (or Tab), and types in the name of the file that he wants to work on. When he hits Enter again, SEL.BAT is created, run, and (under DOS 3.3 or later) deleted after use. (With earlier DOS versions, SEL.BAT will be overwritten the next time that TASK.BAT is run.)

In this example, the template file, SEL.TPL, contains the actual program names to be passed to the output file. Provided their sequence is retained, these names could be added to SEL.MNU, shown in Figure 4, as constant fields. Using F5 and F6 to start and end each constant field, you might add a line like

```
{WPROC} {PERT} {SPREAD} {DBA}
```

below line 4 in SEL.MNU, for example. (While creating the file, you can use F3 to display the constant-field curly brackets and the square brackets used for regular input fields.) Although the program names will take up character positions on the screen, you could use the display-off attribute so that they would remain invisible to the user. And by putting the required constant data in the screen file, the contents of the SEL.TPL file would be reduced to

```
{[1]} [2]
```

Although space does not permit a step-by-step run-through, you'll get a fuller idea of MENU's power by considering the more complex example shown in Figures 6 through 9. Here, MENU is used to automate and simplify the task of sending an ASCII file through a fax program. Some fax programs do not create a cover sheet and also require a complex command line with operands and options that, in your use of the program, will always be the same.

FAX.BAT (Figure 6), the main batch file, is invoked by simply entering

```
FAX filename
```

FAX1.MNU and FAX1.TPL (Figures 7 and 8) get the cover sheet information and create an ASCII file containing the cover sheet page. FAX2.TPL, as follows

```
SET FAXFILE$=[1]
```

works with FAX2.MNU (Figure 9) to obtain the filename if FAX is called without a legitimate filename.

Even more-complex menus and templates can be constructed using multiple output files and constant fields in menus to create menus that update other menus or that create additional menus and templates. Your imagination is the only real limit. The fax example above is a subset of such a group of batch files and menus.

MENU'S EDITING KEYS

Key	Description
Esc	Terminate MENU without producing output files
Enter	Move to next line of input field or next field or finished if in last field
Ctrl-Enter	Finished with input, produce output
Tab	Move to start of next input field
Shift-Tab	Move to start of current input field or if already at start, move to start of previous one
Home	Same as Shift-Tab
↑	Move up one line
PgUp	Move up one screenful
←	Move left one character
→	Move right one character
End	Move to end of field
Ctrl-End	Move to end of menu
↓	Move down one line
PgDn	Move down one screenful
Ins	Toggle insert mode
Del	Delete character under cursor
Alt=	Insert next character in display even if it is a control character. Used to put the graphics for CR, LF, ESC, and TAB in the display.

Figure 3: Here are some additional keys for you to use when working with MENU.

In the complete fax system I've implemented, for example, there is a selection menu for telephone numbers that contains an option to update itself. The telephone list contains each known destination and its telephone number. The telephone numbers are stored as constant fields so that they can be extracted by the template and passed to the fax program. Typical lines look like this:

```
1.  Company A  8005551212
2.  Company B  4045551212
```

You choose the destination by entering the item number, and the template obtains the actual phone number with a {[1]} reference. Entering a 0 signals a request to update the list, and the resulting batch file uses MENU with another screen and template file to update the screen file for phone numbers and its own screen file.

As a further stimulus to experimentation, another part of my office's fax system uses the line

```
DIR *.FAX|SORT|MENU /D/N
```

to display a sorted list of the fax files that have already been sent.

HOW MENU WORKS

MENU is a fairly large program, but it is very straightforward. It uses few hardware- or DOS-related tricks, so understanding it is mostly a matter of following the code. The program consists primarily of procedures that are called to process each character, whether that character is in the screen file or the template file or is input from the console. The open procedures are entered and exited with a JMP rather than with a CALL and RET.

MENU.ASM consists of four sections: the screen-file-processing section, the display-editing section, the template-processing section, and the program-initialization section.

Though executed first, the *program-initialization* section is physically located at the end of the program. This way, since this section isn't needed after it executes, its space in memory can be reused for part of the display buffer. The initialization section consists of the procedures INIT, READ_SCREEN, and OPEN_FILE. INIT first scans the DOS command line using the OPEN_FILE procedure to obtain the screen file, template file, output files, and options.

Each time OPEN_FILE is called, it scans one more field on the command line and tries to open or create (for output) the files. OPEN_FILE also checks for the switch-option letters; this allows them to

HOW TO CREATE A TEMPLATE FILE

by Ron Q. Smith

A template file has a format very similar to that of the screen file. Most characters in the template file, including CR and LF, are sent directly to the output files without change. When MENU first starts reading a template file, all output is sent to the first output filename given on the MENU command line. Special characters in the template file allow you to extract information from the display and send it to the output files, to send the edited date and time to the output file, and to change output files.

No additional control characters are inserted when information is copied to the output file either from the template file or from the display. You can create records of arbitrary length in the output file—indeed, you'll create *very* long records unless you insert LF characters at appropriate points in the template file. Normally you need not be concerned about this, since your template file will usually have the same structure as your desired output file. When you create the template file with your text editor, LF characters will be inserted everywhere that you start a new line. However, if you are copying a multiline input field or constant field to the output file, you will probably want to be sure that each line on the screen is a single record in your output file. The MENU program does not assume this, because you may want to create a long data record for some program or break up the field at some other width than the display-line width.

The special characters used in the template file are as follows:

`\` Do not send the \ to the output file, but do send the next character even if it is a control character.

`[` Send an input field or time-and-date pattern to the output file. If the characters immediately following the [are decimal digits, an input field is selected. If they are anything else, a time-and-date pattern is processed. For example, [1... indicates that the first input field is selected; [00091... selects the 91st input field. On the other hand, [abc... selects time-and-date editing.

When an input field is selected, another level of template processing begins. Again, all characters except special characters are sent to the output file directly, therefore allowing you to mix template information with the input field information. The special characters that are used within an input field reference are itemized below:

`\` Do not send the \ to the output file, but do send the next character, even if it is a control character.

`]` End of reference. Send all remaining input-field characters to the output file. Thus, [5] sends all of input field 5 to the output file. Trailing blank characters in the input field are never sent to the output file.

`?` Send the next (one) input field character to the output file.

`=` Send all remaining characters in the current display line of the input field to the output file. Since the input field itself does not include carriage-return and line-feed characters, the template will usually contain a sequence such as

```
[1=|
  =|
  =|]
```

to move a multiline input field to the output file.

`!` Stop processing the [...] if no more characters remain in the input field. The template file is scanned until the] is found. If a time-and-date pattern

appear anywhere on the command line. If no filename is specified (that is, if a comma appears), a default file is used. The default for the screen and template files is to skip those processing sections. However, if the /D option is specified, a default of STDIN is used for the screen file. STDOUT is used as a default for the first output file if there is a leading comma. Subsequent missing output files are ignored.

Starting at the label CHECK_VID, the INIT procedure determines the type of video adapter that is in use and saves the current video-state information. The number of columns and lines on the current screen are also determined and saved for use by the display routines. If a Color Graphics Adapter (CGA) is in use, a slow screen update is needed to avoid snow. For any other adapter, a fast update is desirable, so a flag is set for testing by the screen read and write procedures.

If the display is already in one of the text modes, the display mode is not changed. If it is in a graphics mode, the display is initialized to mode 3 (80-column color text). Unless the /N option is in effect or the display was in a graphics mode, the contents of the display are saved so that they can be restored when MENU exits. The space remaining in the 64K segment is available for the display buffer and is initialized with blanks.

The *screen-file-processing* section starts after the label BEGIN. This section reads the screen file and then builds the display buffer and the input and constant-field tables. The display buffer contains character and attribute byte pairs exactly as they will be transferred to the screen. The use of a display buffer permits menus to be

is selected, similar processing occurs, except that the special characters are mostly two-letter combinations. All characters in the pattern are sent directly to the output file until a special character is discovered. The special characters follow:

[\] As above.

[]] End of pattern. Resume normal template-file processing.

[MM] Replace with the numeric month of the year (01 to 12).

[DD] Replace with the numeric day of the month (01 to 31).

[CC] Replace with the numeric century (19 or 20).

[YY] Replace with the numeric year (00 to 99).

[MN] Replace with the alphabetic three-letter abbreviation for the month.

[DW] Replace with the alphabetic three-letter abbreviation for the day of the week.

[hh] Replace with the numeric hour of the day (00 to 23).

[mm] Replace with the numeric minute (00 to 59).

[ss] Replace with the numeric second (00 to 59).

For example, [DW MN DD, CCYY hh:mm:ss] might result in Mon Jul 12,1989 21:15:34. The time-and-date pattern is case sensitive.

[{] Send a constant field to the output file. Editing of constant fields is not supported. Only two forms of reference are permitted. {*nnn*} sends the *nnn*th constant-field to the output file. {[*nnn*]} is an indirect constant field reference and is the most important use of constant fields. The *nnn*th input field is used to obtain a decimal number. That constant field is then sent to the output file.

Assume, for example, that the template contains {[5]} and that the fifth input field contains 2. The contents of the second constant field are sent to the output file.

[<] Switch output files. The usage must be <*nnn*>. The *nnn*th output file named on the MENU command line becomes the current output file. All further output will be concatenated to the end of that output file. Note that output files are not closed when a switch occurs. This allows you to switch back and forth among output files. ■

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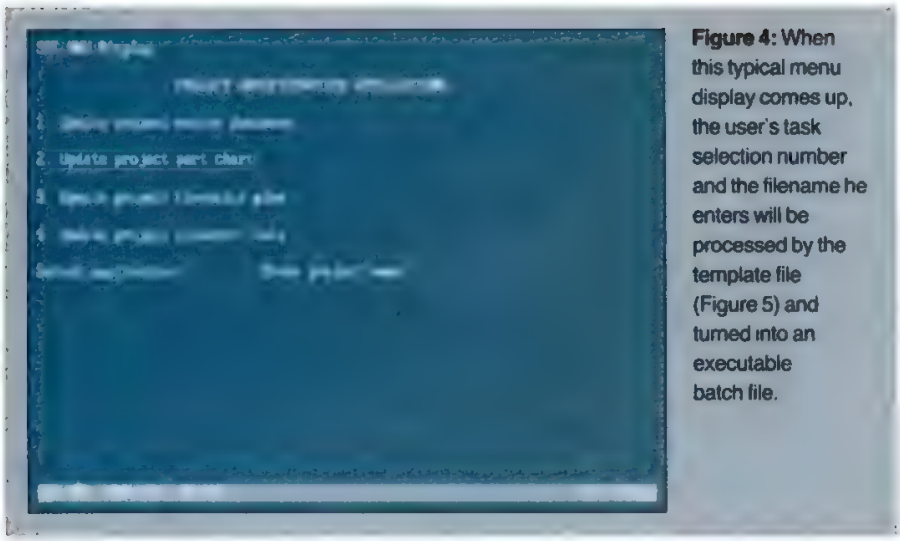


Figure 4: When this typical menu display comes up, the user's task selection number and the filename he enters will be processed by the template file (Figure 5) and turned into an executable batch file.

much larger than a single screen.

The screen file is scanned, one character at a time, using the GET_CHR procedure. The TBL_SRCH procedure is called to determine the character type. It returns an index used to branch to the procedure that handles the appropriate character type. Most characters result in a branch to SCR_PUT and so are simply entered in the display.

The carriage-return (handled at label SCR_CR) and line-feed (SCR_LF) characters always mean the end of a display line. The current line is filled out to the end with blanks. A line feed immediately following a carriage return is ignored.

The [character (SCR_LBRK) starts an input field. An entry is made in the input-field-definition table (EDIT_AREA) that saves the display address. When a] (SCR_RBRK) is encountered, the end of the input field is entered in the table. Similar handling of { and } (SCR_LBRACE and SCR_RBRACE) creates entries in the constant-field-definition table (CONST_AREA).

An ESC character (SCR_ANSI) signals the start of an ANSI display attribute sequence of the following form:

```
ESC[#;#;...m
```

The display attribute to be applied to a subsequent character is changed just as ANSI.SYS or ANSI.COM would change it. Because you might want to put [,],{,}, and the graphics characters represented by CR, LF, and ESC in your menu, however, the \ character (SCR_FORCE) always puts the next character from the screen file in the display buffer. (You don't have to worry about all of these special characters when you create your screen file; MENU /E takes care of all that for you.)

When the end of the screen file is reached (this is indicated by a return from GET_CHR with the Zero Flag set), the code at EDIT_RDY checks to see if all input and constant fields were correctly closed. If a MENU /E is being used to update an existing menu, the input-field-definition table (EDIT_AREA) is copied to a new input-field-definition table (DEF_AREA) and a single input-field definition consisting of the entire display is placed in EDIT_AREA.

The input-processing section starts at EDIT_NMT. When the first screenful is displayed, keystroke processing from the console begins with a loop at EDIT_FILE. The WTBL_SRCH procedure looks up the key type and then calls the appropriate key-processing procedure. Most keystrokes go to EDIT_PUT, which inserts the character in the display buffer (if in an input field), moves the cursor-right one position (by falling into the cursor-right procedure RIGHT_SUB), and updates the screen display. If insert mode is in effect, the characters in the current input field are shifted right one position in order to make room for the inserted character.

Most of the key-handling procedures simply calculate a new cursor position, either in the form of an index to the display buffer or as a signed offset to the current cursor position. The real cursor-handling logic is associated with the code at MOVE_CRS, which adds the signed offset to the current cursor position, and at MOVE_TO, which moves the cursor to a display buffer index. MOVE_TO first determines if the new cursor position is currently on the screen. If not, the screen is redisplayed with the new position in the first or last line, depending on the direction of the motion. MOVE_TO then checks to see if the cursor is in an input area by using the FIND_AREA procedure. If it is not, it checks to see if there is an input area beyond the cursor but on the current screen, and it then moves the cursor to the start of that input area.

SEL.TPL — **COMPLETE LISTING**

```
IF ([1])==(1) WPROC [2]
IF ([1])==(2) PERT [2]
IF ([1])==(3) SPREAD [2]
IF ([1])==(4) DBA [2]
```

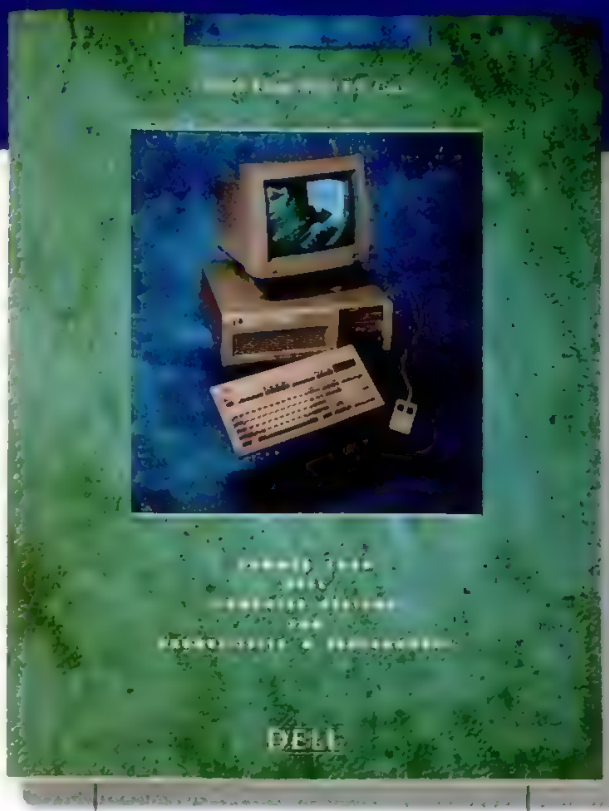
Figure 5: The information from the screen file (Figure 4) is passed through a template file before being made into an output file.

FAX.BAT — **COMPLETE LISTING**

```
@ECHO OFF
SET FAXFILE$=%1
IF (%FAXFILE$%)==() GOTO GET_FILE
IF EXIST %FAXFILE$% GOTO HAVE_FILE
:GET_FILE
MENU /N FAX2.MNU FAX2.TPL FAX$.BAT
CALL FAX$.BAT
DEL FAX$.BAT
IF (%FAXFILE$%)==() GOTO END
IF NOT EXIST %FAXFILE$% GOTO GET_FILE
:HAVE_FILE
MENU /N FAX1.MNU FAX1.TPL FAX$.CVR
COPY FAX$.CVR+%FAXFILE%
FAXPRG /FFAX$.CVR /N /P /TTEL.FIL
DEL FAX$.CVR
SET FAXFILE$=
:END
```

Figure 6: FAX.BAT is the main file of a more complex example of MENU's power.

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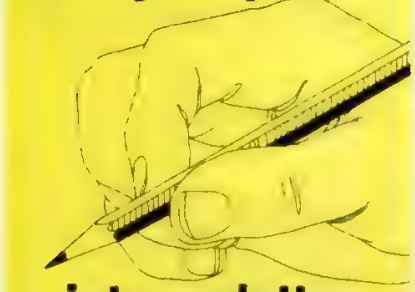
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Figure 7: The main MENU screen file for FAX.BAT obtains user information for the cover sheet.

The logic at EDIT_STATUS updates the cursor coordinates in the status-line display and the physical cursor position on the screen. Input processing is finished when Ctrl-Enter (CENTER_SUB) or Enter is pressed at the end of the last input field. CENTER_SUB is both the end of the input-processing section and the start of the template-file-processing section.

Template-file processing starts by restoring the original screen display and obtaining the current time and date. Getting the time and date once ensures that the template-editing functions use a consistent set of values throughout.

The template file is handled very much in the manner of the original screen-file processing. The template file is scanned, one character at a time, using GET_CHR. TBL_SRCH is called to determine the character type, and a branch is made to the appropriate type-handling procedure. Most characters are simply sent to the current output file (initially, the first output file) at TMPL_PUT.

A \ character (TMPL_FORCE) causes the next character in the template file to be sent to the output file, even if it is otherwise a control character. This allows the <, >, [,], {, }, and \ characters to be sent

FAX1.TPL — **COMPLETE LISTING**

```
                    COMPANY NAME
                    STREET ADDRESS
                    CITY, STATE ZIP
                    TELEPHONE NUMBER

FROM: [1=
=
]
TO: [3=
=
]

PREPARED ON [DW MN DD, CCYY at hh:mm]

COMMENTS:
[4=
=
=
=
=
]

In case of any trouble please contact the sender at [2].
```

Figure 8: The main MENU template file turns the information from the user's screen input into a formatted fax cover page.



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CIRCLE 166 ON READER SERVICE CARD

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to the output file. A < character (TMPL_FILE) signals a change in output file. The next characters are assumed to constitute a decimal number, followed by >. The number that appears is an index (1 to 64) of the output files given on the command line. The selected file becomes the current file.

A [character (TMPL_SENT) signals the start of a substitution pattern. An input field may be copied ([*nnn* . . .]) or a time- and date-substitution pattern may be processed ([MM . . .]). If a decimal number immediately follows the [, a branch is made to DO_INP, which then processes the input-field reference. Otherwise, the branch is to CHK_PAT to process a time- and date-substitution pattern. DO_INP simply repeats the logic pattern used for the template file as a whole, using different character-type and procedure-vector tables.

While most characters from the input-field pattern are copied directly to the output file, a few (?, =, |,], and \) require special processing. As before, the \ character (COPY_FORCE) copies the next character from the pattern to the output file, thus allowing the special characters to be placed in the output file.

The | character (COPY_STOP) terminates input-field processing if there are no more nonblank characters in the input field; it simply goes on to scan for the]. When the] is encountered, any remaining characters from the input field are copied to the output file.

Anything other than a decimal number following the [results in a branch to CHK_PAT to do time and date substitution.

The processing is very similar to input-field references, with most of the characters going directly to output, \ forcing a character to output, and sentinels causing substitution. The only difference you'll notice is that these sentinels are specific two-character alphabetic sequences (MM, DD, CC, YY, hh, mm, ss, DW, MN, for example). Each of these is replaced in the output file by the two (three in the case of DW and MN) characters that represent the time and date.

A special block of code starting at COPY_SCRN is used when a screen file is created or updated using MENU /E. In this case, no template file is used and the logic is basically a reverse of the screen-file-processing section.

The display buffer is scanned and a file is created that would reproduce that display buffer if it were used as a screen file. Special handling is required to generate the ANSI video-attribute sequences whenever the attribute changes in the display buffer and to insert the [] and {} pairs around input-field definitions and constant-field definitions, respectively. Otherwise, the logic converts one screen line into one output-file record, which is terminated by a CR LF pair. When the template-file processing is complete, all output files are closed (WF_DONE) and the program exits (EXIT_DOS).

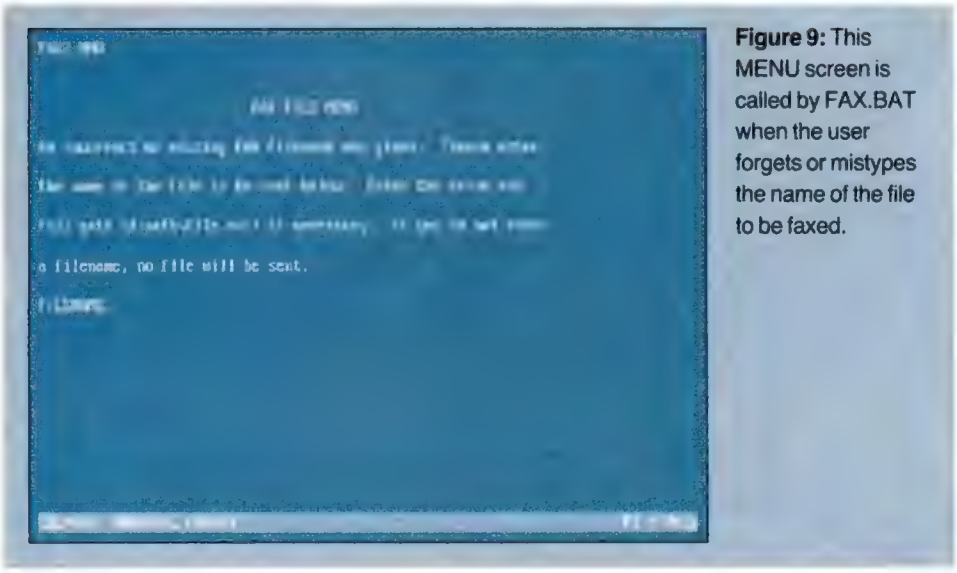


Figure 9: This MENU screen is called by FAX.BAT when the user forgets or mistypes the name of the file to be faxed.

The ? character (COPY_ONE) copies the next character from the input field to the output file. An = (COPY_LINE) makes it easy to handle a multiple-line input field by allowing the remaining characters in the display line to be copied from the input field to the output file.

SUMMARY

MENU can be used with simple screen formats and correspondingly simple template files to give all of your batch files an attractive, easy-to-use, custom-designed appearance.

The MENU utility can be used with simple screen formats and correspondingly simple template files to give all of your batch files an attractive, easy-to-use, custom-designed appearance.

Don't overlook the possibility of using MENU with only a screen file and no template or output files. It can display information screens in colors that themselves convey information to a user. Pressing Enter or Ctrl-Enter will then go on to the next step in your batch file. Compare a fully formatted screen to a series of ECHO commands followed by a PAUSE for screen appeal! And you get this advantage without having to use ANSI.SYS or ANSI.COM to control the screen. Moreover, you can use MENU with a template file but no screen file to create output files containing edited time and date information.

When you do want to create a sophisticated application, linking together multiple programs and batch operations, MENU has the power to support you. And all without any programming—unless, as a diehard who *has* to program everything, you call the template file a program. ■

Ron Q. Smith is manager of software development for Unisys Corp. in Roseville, Minnesota.

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MENU Command

Ron Smith October 31, 1989 (Utilities)

Purpose: To combine information from full-screen displays and user keyboard input to create batch and other program input files under the control of a template file. Full-screen editing facilities are provided for displays of up to 300 lines and up to 100 input fields.

Format: `MENU [/D/E/N] screen template out1 [out2 ...]`

Remarks: The *screen* operand is the file containing the display. A screen file is created by entering MENU /E *,,screen* and can later be edited by entering MENU /E *screen,,screen*. The commas are used to replace omitted file operands.

The *template* is a file that controls the format of the output files. A template file is created with any ASCII text editor and contains constant data and instructions for copying information entered on the display.

The *out* files are constructed from the information on the display and in the template files. Up to 64 out files may be created.

The optional /D switch is used to display any screen or other ASCII file of up to 300 lines. If the screen file is not specified, the DOS standard input file is assumed. The number of screen columns and rows is automatically determined, and all sizes of displays up to 255 by 255 are supported.

The /N (no-restore) option is used to inhibit MENU from saving or restoring the original DOS screen contents when exiting. This switch is normally invoked when loading programs that paint their own opening screen.

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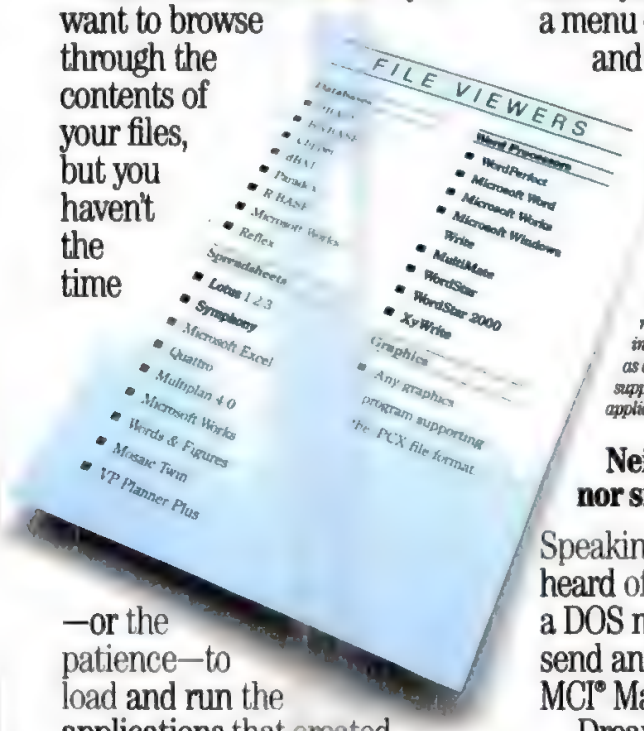
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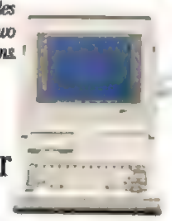
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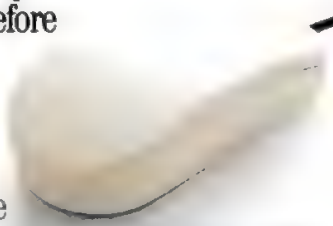
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CIRCLE 235 ON READER SERVICE CARD

The output samples above were printed on a MICROLINE 380 using WordPerfect 5.0 and Gemgraph.

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by
Charles Petzold

Environments

The Marriage of Text and Graphics, Part 2

■ If vector-based fonts are so good, why do they look so bad? This second of two parts explores what remains to be done to make the text displayed on our screens really match the output from our printers.

Text display is the most important part of any graphics programming system. In my last column, I discussed how the graphics environment of the OS/2 Presentation Manager frees us from the typewriter tyranny of the fixed-pitch font used in character-mode environments and opens up the possibility of displaying text as it was meant to be seen, in proportionally spaced fonts.

In the last issue, I also discussed the two types of fonts found in the .FON font files shipped with OS/2 1.1. Raster fonts store each character as a tiny bitmap, an array of bits that correspond to the dots or pixels that form the character on the output device. Raster fonts must be designed for specific point sizes and specific device resolutions, and manipulation of the fonts is extremely limited.

Vector fonts store each character as a series of straight lines and curves that define the outline of the character. The GPI (Graphics Programming Interface) algorithmically determines the interior of the area and fills it. Vector fonts are independent of point size and device resolution and can be extensively manipulated.

The support of vector fonts in the Presentation Manager is a big step up from *Microsoft Windows*. Even if you wanted it to, *Windows* would have a lot of trouble generating vector fonts, since its Graphics Device Interface (GDI) does not support some of the underlying graphics operations necessary to render them. (The only curves that GDI supports are ellipses.) Further, although GDI can fill areas defined by a series of straight lines, it cannot fill an area defined by straight lines and curves. The enhanced graphics capabilities of the Presentation Manager GPI, on the other hand, make vector fonts possible.

NOW FOR THE BAD NEWS

The problem is that it's not sufficient that GPI be able to render vector fonts. As presently implemented, these fonts present two major problems. The first is performance—the display of vector fonts is much slower than of raster fonts. In a raster font, each character is represented by several bytes of data. It's a simple matter for the GPI to copy these bytes to the screen.

For a vector font, on the other hand, the GPI must first scale all the coordinates that define the character, mathematically calculate the straight lines and curves that connect these coordinates, use a technique called scan-line conversion to calculate the end coordinates of each horizontal scan line that falls within the interior of the outline, and then draw these lines. That's just for one character, and this is a very slow process. For this reason, a Presentation Manager program must use raster fonts rather than vector fonts for displaying any considerable amount of text on the screen.

Figure 1 shows two Presentation Manager windows, each containing the first paragraph of Mark Twain's *The Adventures of Huckleberry Finn*. The window on the upper left uses the 10-point Times Roman GPI raster font. The one on the lower right uses a Times Roman GPI vector font scaled to about the same size as the raster font. On a 20-MHz 386 machine with a VGA, the text using the raster font was displayed almost instantaneously. The paragraph of text using the vector font required 15 seconds to be displayed. You probably haven't seen text displayed so slowly since the days of 300-bpi modems!

These two windows also show very clearly the second major problem of GPI vector fonts. At common point sizes and common video display resolutions, GPI vector fonts look extremely ugly. Why is this so?

DUMB VECTORS

Font design is an art, and designing fonts for a low-resolution raster medium such as a video display requires lots of art, magic, and compromise.

Let's look at the raster font in Figure 1 first. (This is a rather poor Times Roman font, which we can hope will ultimately be replaced in a later release of OS/2. But, poor as it is, it can prove a point.) Do the strokes look a little thin to you? Perhaps they are. The designer of this particular font (10-point Times Roman on a VGA) has chosen to make all the strokes 1 pixel wide. Perhaps the strokes should be a little wider, maybe even 50 percent wider. But that would require each stroke to be 1.5 pixels wide, and that's clearly impossible. The only alternative would be 2-pixel-wide strokes, and this would make the font too dense. Nonetheless, there is at least some visual consistency in the raster font.

Now look at the vector font. It looks ugly because some of the strokes are 1 pixel wide, some are 2 pixels wide, and

some are 3 pixels wide. Extraneous pixels seem to appear on the curves of some letters. That's not consistency. That's a total mess. What's going on here?

Remember that the definitions of the characters in a vector font are simply a series of coordinates; there is no information that the GPI can use to scale the coordinates in an intelligent manner. (That's why the two uppercase *M*'s in *Mr.* and *Mark* have different widths in their left vertical stroke.) What you see in Figure 1 are the rounding errors in coordinate placement that result from generating from "dumb vectors" alone.



Figure 1: A comparison between the GPI Times Roman 10-point raster font (left) and vector font (right) on a VGA vividly shows the effect of rounding errors that could be minimized by using intelligent vector technology.

So, while it is very exciting to find support for vector fonts in the GPI, it is also very disturbing to see that they aren't implemented very well.

As font size or resolution goes up, the vector fonts improve in appearance. The rounding errors still exist, but they are much less visible. Figure 2 shows two paragraphs of the same text printed on a 300-dpi PostScript printer. Both paragraphs were printed by a Presentation Manager program using identical code, with one exception: for the first paragraph, the program requested the PostScript Times Roman device font. For the second paragraph, the program requested the generic Times Roman GPI vector font. The GPI font is still not quite as nice as the PostScript font (there's a slight graininess that results from the rounding errors), but it's certainly acceptable.

To create Figure 2, I used an early version of a PostScript driver for the Presentation Manager that Microsoft is developing (it was actually distributed in the final installment of the OS/2 Software Development Kit). The PostScript driver generates PostScript code from GPI drawing commands. The driver was not quite bug-free, so I had to direct driver output to a file and make a few changes to it before copying it to a PostScript printer.

It was interesting to look at the file that printed these two paragraphs. The file was over 400K long. About 2K of this file was required to print the first paragraph; the rest of the file was devoted to printing the second paragraph. That's a ratio of 200 to 1—quite a difference!

When you are displaying text from a Presentation Manager program to a PostScript printer using a built-in PostScript font, the amount of PostScript code passed to the printer is minimal. The font is selected and scaled using the PostScript `findfont`, `scalefont`, and `setfont` commands. The text strings are displayed using `moveto` and `show`. But when using a GPI vector font, each character requires a series of `moveto`, `lineto`, and `curveto` commands to define the outline of the character, followed by `eofill` to fill the interior. Not only is there a lot of data to be passed to the printer, but the printer itself requires much more processing time to display the text.

Of course, you don't need a PostScript printer to print text using the GPI vector fonts. Any laser printer will do if you have a PM device driver for it. For non-PostScript printers, the device driver will probably have to convert each character of the vector font into a bitmap and then convert that into a control sequence the printer can understand. Using the GPI vector fonts will still be much slower than using the printer's built-in device fonts, but the GPI brings PostScript-like capabilities to non-PostScript printers.

APPROXIMATING WYSIWYG

Pity the poor programmer who must make use of fonts in a PM program. The rules are fairly simple, but the implications are disturbing. Here are the rules:

- For text on the video display, only the GPI raster fonts offer sufficient performance and legibility. GPI vector fonts should be restricted to short text strings at 24 points or larger (for example, headlines in a desktop publishing document).
- When printing on a dot matrix printer, the program can use the printer device fonts and GPI raster fonts. As with the video display, GPI vector fonts should be limited to short text strings in the larger font sizes.
- When printing on a laser printer, the program can use the printer device fonts and GPI vector fonts. The printer device fonts are preferred for fastest printing speed and best appearance.

Some programs that work with text (such as word processing and desktop publishing applications) use the video display to show the user what the document will look like when printed. This is the whole idea behind WYSIWYG (what you see is what you get), and it is a very important goal in any graphics system.

It's interesting to note how the definition of a WYSIWYG word processor has changed over the years. At one time, any program that could show line breaks onscreen correctly when working with what would be printed in different fonts was called WYSIWYG. Next, *Microsoft Word* was considered "real" WYSIWYG because it displayed italics, boldface, underlining, and subscripts on the screen. Certainly no one would claim today that *Word* is a WYSIWYG word processor: it uses only one font in one size on the screen, regardless what it prints! There is no visual difference between a Courier font and Times Roman font in a *Word* document displayed on the screen. (*Word* now has a "preview mode" that lets you see something much closer to the printed results, but you can't edit a document in preview mode.)

When *Microsoft Windows* was released, the WYSIWYG mantle passed to the *Write* word processor, because it had



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access to all the *Windows* raster fonts. (These are basically the same as the Presentation Manager raster fonts.) But users soon discovered that the screen display did not exactly show the appearance of printed output. The video display can only approximate printer fonts. The program can calculate line breaks based on the amount of text that the printer can fit in one line, but it must use the *Windows* raster fonts to mimic the printer fonts. That's an approximation, and at times a very gross one.

Some people can accept this kind of discrepancy, contenting themselves with the recognition that it is a natural limitation of current font and video display technology. But it drives me crazy. I want to see on the screen what I'll be printing on the printer, not in some noninteractive preview mode, but as a matter of course. True WYSIWYG—where the visual difference between the video display and the printed output is only a matter of device resolution—seems to me an obvious goal. Yet it is still not possible in the Presentation Manager if we observe the rules that I listed above.

In fact, achieving even the *Windows Write* type of WYSIWYG is more difficult in the Presentation Manager than in *Windows*. *Windows* incorporates a feature called "font mapping." Usually, a *Windows* program like *Write* obtains the names and sizes of all the fonts that can be used on a particular printer and lists them for the user. When the user selects a font, the program can ask *Windows* to use its font-mapping feature to select the screen font that most closely matches the printer font. Font mapping is absent from the GPI, however; the program must implement its own font-mapping algorithms.

A FANTASY

Let's engage in fantasy for a moment. Suppose the handling of vector fonts in the Presentation Manager were greatly improved. Suppose we have a system in which

- the display of vector fonts on the screen is as fast as the display of raster fonts;
- the use of vector fonts on the printer is as fast as the use of the printer's built-in device fonts;
- vector fonts are as attractive as video raster fonts or a printer's built-in fonts; and
- all the fonts you want to use are available as Presentation Manager font files.

True WYSIWYG would then be a reality. If a program ignored the printer's built-in device fonts, all the fonts used on the screen *and* on the printer would come from one source: the Presentation Manager vector font files. Rather than spending your money on font cartridges or downloadable fonts for your laser printer, you'd purchase vector font files for the Presentation Manager. These could be used in any PM program on any output device.

This arrangement would also solve another common font problem: the difference in character sets between screen fonts and built-in printer device fonts. As I discussed here in connection with the PMASC program (August 1989), the Presentation Manager fonts support 16 different ASCII and EBCDIC codepages. Although all printers used with PCs support the ASCII character set, there is not much consistency in the use of character codes of 128 and higher. Using the Presentation Manager vector font files for both the screen and printer text would eliminate this problem. Even symbol fonts, in which the character codes are mapped to various symbols instead of to alphanumeric characters, would be entirely consistent between the screen and the printer.

Is this a fantasy, or is it within our grasp? And if it really is within our grasp, is it desirable?

A PAGE FROM POSTSCRIPT

Since PostScript already uses vector fonts exclusively, it's well to consider how Ado-

POSTSCRIPT'S VS. PRESENTATION MANAGER'S VECTOR FONTS

PostScript 'Times-Roman' font

You don't know about me, without you have read a book by the name of "The Adventures of Tom Sawyer," but that ain't no matter. That book was made by Mr. Mark Twain, and he told the truth, mainly. There was things which he stretched, but mainly he told the truth. That is nothing. I never seen anybody but lied, one time or another, without it was Aunt Polly, or the widow, or maybe Mary. Aunt Polly--Tom's Aunt Polly, she is--and Mary, and the Widow Douglas, is all told about in that book--which is mostly a true book; with some stretchers, as I said before.

GPI 'Tms Rmn' vector font

You don't know about me, without you have read a book by the name of "The Adventures of Tom Sawyer," but that ain't no matter. That book was made by Mr. Mark Twain, and he told the truth, mainly. There was things which he stretched, but mainly he told the truth. That is nothing. I never seen anybody but lied, one time or another, without it was Aunt Polly, or the widow, or maybe Mary. Aunt Polly--Tom's Aunt Polly, she is--and Mary, and the Widow Douglas, is all told about in that book--which is mostly a true book; with some stretchers, as I said before.

Figure 2: The Presentation Manager's GPI does support vector fonts, although the GPI fonts are not quite as nice as PostScript's. Vector fonts are slightly grainy, because of rounding errors, but this becomes less apparent as the font size increases.

be has set about solving some of the problems involved in generating text from vector outlines. Taking a page from PostScript (so to speak) may help to improve the GPI.

One of the problems posed by GPI vector fonts is performance, or speed. Generating a character from a vector font outline requires extensive calculations. As any PostScript-printer user knows, Adobe has not entirely solved this problem. But PostScript implements a technique called "font caching" that helps considerably.

When PostScript needs to display text in a particular font, it uses its font outlines to generate bitmaps of the characters. These bitmaps are saved in memory and are used subsequently to render the text on the printer page. Often, when a program prints a document on a PostScript printer using two or three fonts, the first page takes a little time to print, because the printer must first generate and save bitmaps that correspond to the characters in the fonts. But subsequent pages print much more quickly. This is the performance benefit of font caching.

The GPI definitely needs font caching for its vector fonts. It's obviously not easy to implement in a multitasking environment where several programs may be using a variety of different vector fonts, but it will help performance a lot.

Adobe has also solved the problem of rounding errors that occur when converting a vector outline into a bitmap. Adobe's fonts are actually a combination of code and data that supplies "hints" required for accurate font renditions. Other font manufacturers (such as Bitstream) have developed similar software technologies. There are products currently available for *Windows* and for laser printers such as the Hewlett-Packard LaserJet II that take advantage of this technology to generate raster fonts from vector outlines.

To make the GPI vector fonts truly useful, it will be necessary to bring such technologies into the Presentation Manager. Does this mean that Microsoft or IBM must purchase an existing font-generation technology from Adobe or Bitstream or must even develop its own? Not at all. Instead, the Presentation Manager must allow third-party manufacturers to offer PM font files that combine code and data to generate fonts from outlines intelligently. All that the GPI need do is use the generated fonts without worrying about the actual algorithms. This is an approach much in the spirit of object-oriented programming.

I want to see this vector font technology integrated in the PM in such a way that it is entirely transparent to the user and doesn't generate raster font files, as the solutions used with *Windows* currently do.

According to published reports in some of the trade magazines, Microsoft is already considering something like this for a future update of OS/2. (Microsoft has made no official announcement of its intentions.) It is conceivable that the GPI will someday be able to use third-party font files containing both code and data to generate fonts intelligently from vector outlines, much as PostScript does today. This would certainly be an important improvement to the GPI and would move it to the forefront of graphics programming systems while maintaining an open architecture so that third-party manufacturers can get involved.

THE ROLE OF THE PRINTER

While visiting fantasy land, I suggested that a program can obtain a true WYSIWYG display only if it ignores printer device fonts and uses GPI vector fonts for all screen and printer text. This assumes that these vector fonts will be properly implemented, of course.

Is this desirable? Probably not. Certainly it's very different from the way we think of printers today. In recent years, we have seen large markets evolve that offer a variety of font cartridges and downloadable fonts for Hewlett-Packard laser printers, and downloadable fonts for PostScript printers. Adobe alone, for example, markets nearly 500 downloadable fonts for PostScript printers.

There is a compromise. Suppose that for each font built into a laser printer, for each font cartridge, and for each downloadable font, there were also a GPI vector font file that could duplicate the printer fonts on the screen.

This is not inconceivable. For example, Adobe currently supplies *Windows* font files that contain raster font definitions (in 10-, 12-, 14-, 18-, and 24- point sizes) that correspond to their downloadable PostScript vector fonts. It seems reasonable that Adobe could one day supply GPI vector font files that would allow you to use these fonts in any point size on the screen.

This would give us the best of both worlds. Printers could be as fast as they are now, but true WYSIWYG would be possible, because the GPI could use vector font files that render on screen what the printer device fonts print on the page.

What's important at this point is for font generation in the GPI to move beyond "dumb" vectors to an intelligent combination of code and data that can render fonts without rounding errors. Font caching must also be implemented to improve performance. Perhaps most importantly, the use of these fonts must be transparent to the user. Printer drivers must transparently download printer fonts to the printer, and video display drivers must transparently generate screen fonts that duplicate these printer fonts.

I realize that this is a tall order. Yet I want GPI to be the best graphics system available on personal computers, and the adoption of an intelligent vector font technology is necessary to achieve this goal.

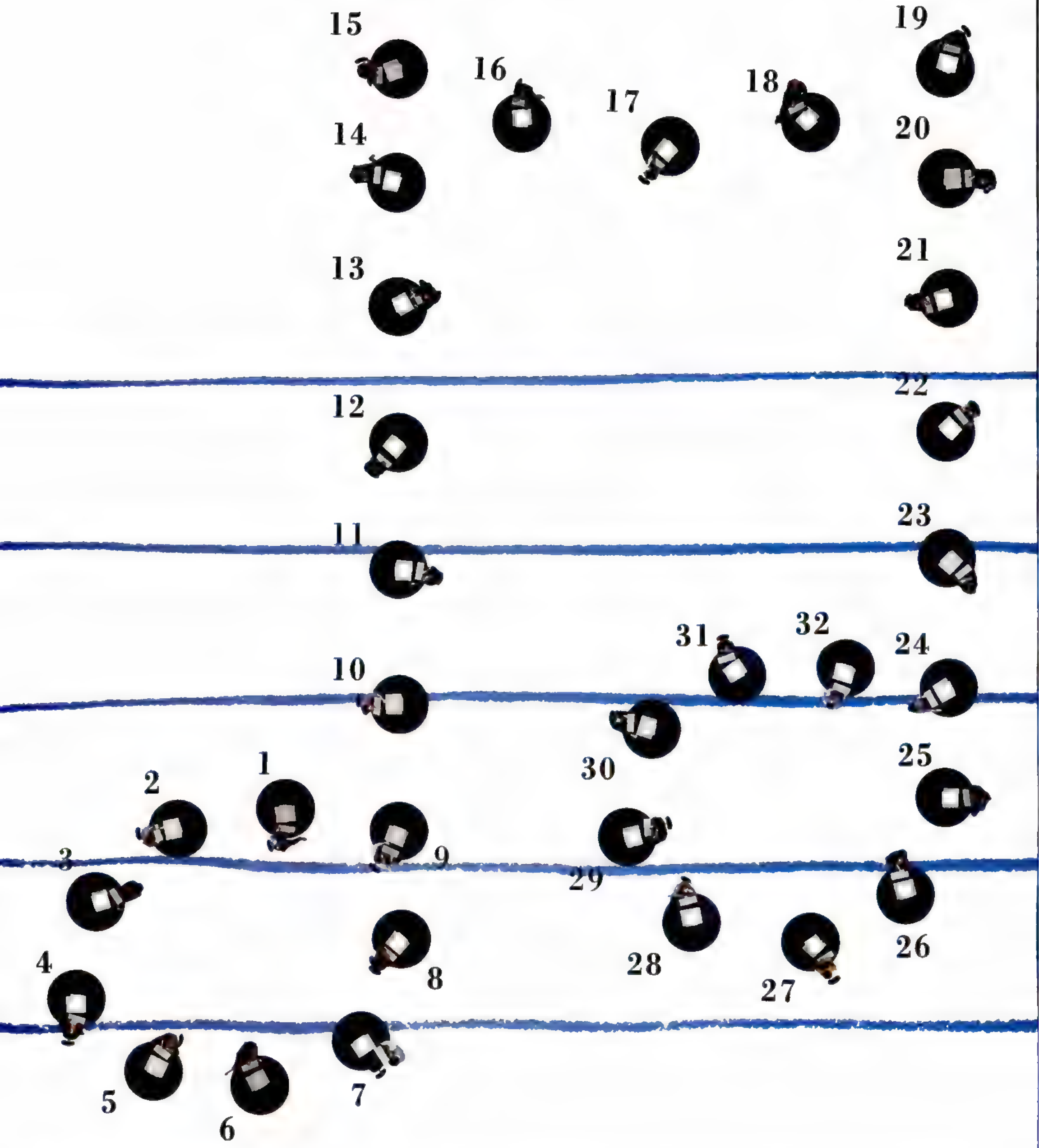
IMAGINING THE FUTURE

There are some who say that we are not yet ready for the accurate rendition of fonts on the video display. Current video displays are low-resolution devices. The VGA has only about 68 dots per inch, and even the IBM 8514/A has only 92 dpi. I would classify a 300-dpi laser printer as *medium resolution*, and the 2,400 dpi common in professional typesetting as *high resolution*.

But we must be ready for the future. The normal rule is "software follows hardware." Advances in hardware occur before we have the software that takes advantage of it. (We still do not have a version of OS/2 that takes advantage of the 80386, for example.) I'd rather see software anticipate hardware. A good solid vector font technology built into the PM will be ready for inevitable future improvements in video display and printer resolution.

Perhaps raster fonts cannot be abandoned entirely just yet. Particularly for low-resolution devices such as video displays, a raster font designed by a human being will always be more readable than a vector font. Font designers can do certain things to trick the eye into thinking the characters are smoother than they actually are. Thus, the default system font used on the screen should probably remain a hand-designed raster font.

But for a Presentation Manager program that must prepare printed output, vector fonts are the way to go. Someday I want to hold a printed page to my video display and see two images of the same document that differ only in resolution. Nothing short of this goal is acceptable. ■



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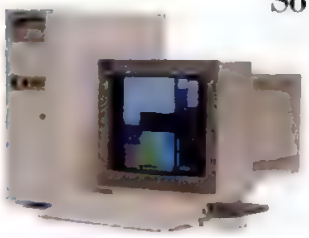
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by
Ray Duncan

Power Programming

Converting Your DOS Programs into 80386 Protected-Mode Code

■ The third in this series tells you what to watch for at each step and includes practical routines for your programming library.

Having covered the general issues in previous installments, it's time now to get down to the specifics of 80386 32-bit protected-mode programming. As I've explained, the 80386 code presented here will rely on DOS-based programming tools and DOS extenders—specifically, on Phar Lap's 386ASM, 386LINK, 386LIB, 386DEBUG, and the Phar Lap DOS extender, RUN386.

The easiest way to get started is to convert some of your existing, 16-bit real-mode DOS applications into true 80386 32-bit programs. This allows you to use working, well-understood code as a testbed while you become familiar with the 32-bit protected-mode instructions and addressing modes. The issues you must address in making such a conversion can be grouped into four broad categories: segmentation and memory management, CPU architecture, command-line and environment processing, and the application program interface to the operating system.

SEGMENTATION/MEMORY MANAGEMENT

The first requisite for successfully converting an application from real mode to protected mode is to make sure that the application is properly segmented. You must use the SEGMENT...ENDS directives (or the higher-level .CODE, .DATA, and .STACK directives) to logically segregate the program's machine code (text), constants and variable data, and stack. The Linker concatenates the segments of like name when it combines object modules to build the executable file.

If your DOS application is already written to be linked as an .EXE file, you'll probably need to add only the new DWORD and USE32 attributes to its SEGMENT declarations. DWORD tells the Linker to align the module's code or data at addresses that are multiples of four, which speeds up memory accesses on machines with 32-bit buses. USE32 tells the assembler to generate machine code appropriate specifically for 80386 32-bit protected mode.

Most 80386 protected-mode applications use a "flat memory model," in which all logical segments are finally grouped together into a single physical segment. Even so, however, it's important that you continue to follow the same familiar segmentation conventions as you would for DOS .EXE files and OS/2 protected mode. The reason for this is that while a true 80386 operating system can (and will) write-protect the code portion of an application's address space at the page table level, the segment attributes provide the only source code mechanism for passing the necessary information to the operating system.

As you convert your code, look for and eliminate any ill-behaved use of the segment registers. Specifically, eliminate any arithmetic manipulation of the contents of segment registers and/or use of the segment registers for "scratch" storage. In protected mode, segment registers contain selectors, which are basically handles for memory segments, rather than physical addresses as in real mode. Loading a segment register with a value that is not a valid selector will cause a protection fault, and (in most environments) your program will be terminated. (See the June 13, 1989, Power Programming column for a more detailed description of selectors and protected-mode addressing.)

80386 CPU ARCHITECTURE

Once you've disposed of any segmentation and addressing concerns, the next step is methodical source code translation. The fundamental change to be implemented is mechanically replacing all 16-bit register references with 32-bit register references. For example, the instruction

```
MOV  AX,BX
```

would be transformed to

```
MOV  EAX,EBX
```

While the 80386 does allow you to reference 16-bit registers in 32-bit protected mode, you generally do not want to use this capability. The reason is that all such references to 16-bit registers (or other operands) in a USE32 segment force the generation of a special "prefix" byte before the instruction. Consequently, references to 16-bit operands do not execute more quickly than references to 32-bit operands; they may well execute more slowly. And they always take up more space.

Like other general rules, however, this one has a couple of exceptions. First, when you copy data between a general register and a segment register, the general register must be a 16-bit operand. For example, to load a segment register with the selector for the program's data segment, you must

write code such as:

```
MOV  EAX,seg _DATA
MOV  DS,AX
```

Second, and similarly, when you use the "long" form of an IN or OUT instruction, you must use DX rather than EDX as the operand that supplies the port number. For example, the instructions

```
IN   AL,DX
IN   AX,DX
IN   EAX,DX
```

are legal, while instructions such as

```
IN   AX,EDX
```

will cause the assembler to generate an error message.

Mechanical translation breaks down, of course, when you encounter source code that twiddles bits and makes extensive use of logical ANDs, ORs, XORs, and shifts to set and test flags and/or isolate bit fields. As a simple example, consider the following real-mode code:

> CWD and CDQ provide a particularly good illustration of how innocently you can introduce nasty bugs into a previously working program.

```
OR DX,8000H ; set flag
 .
 .
 .
OR DX,DX    ; test flag state
JS LABEL1   ; jump if flag set
```

In this sequence, we're using bit 15 of register DX for a flag, and later taking advan-

DUMP.ASM 1 of 3

```
        title   DUMP --- display file contents
        page    55,132
        .386

; DUMP.ASM      Display contents of file in hex and ASCII.
;               80386 version for Phar Lap tools.
;               Also requires 80386 versions of ARGV.ASM,
;               ARGC.ASM, and HEXASC.ASM.
;
; Copyright (C) 1989 Ziff Communications Co.
; PC Magazine * Ray Duncan
;
; Build:        C>386ASM  DUMP
;               C>386ASM  ARGC
;               C>386ASM  ARGV
;               C>386ASM  HEXASC
;               C>386LINK DUMP ARGC ARGV HEXASC  -EXE DUMP
;
; MAKE File:        argc.obj : argc.asm
;                     386asm argc
;
;                   argv.obj : argv.asm
;                     386asm argv
; .
;                   hexasc.obj : hexasc.asm
;                     386asm hexasc
;
;                   dump.obj : dump.asm
;                     386asm dump
;
;                   dump.exe : dump.obj argv.obj argc.obj hexasc.obj
;                     386link dump,argc,argv hexasc -exe dump
;                     bind386 c:\tools\run386b.exe dump.exp
;
;
; Usage:        C>DUMP unit:\path\filename.exe [ >device ]

cr      equ     0dh             ; ASCII carriage return
lf      equ     0ah             ; ASCII line feed
tab     equ     09h             ; ASCII tab code
blank   equ     20h             ; ASCII space code

blksize equ     16              ; input file record size

stdin   equ     0               ; standard input handle
stdout  equ     1               ; standard output handle
stderr  equ     2               ; standard error handle


_TEXT   segment dword use32 public 'CODE'

        assume  cs:_TEXT,ds:_DATA,es:_DATA,ss:STACK

        extrn   argc:near       ; get no. of command line args.
        extrn   argv:near       ; get addr. of command line arg.
        extrn   d2asc:near      ; convert dword to hex ASCII
        extrn   b2asc:near      ; convert byte to hex ASCII

dump    proc    far             ; entry point from MS-DOS

        call    argc            ; count command arguments
        cmp     eax,2           ; are there 2 arguments?
        je      dump1           ; yes, proceed

        mov     edx,offset msg1 ; missing or illegal filespec.
        mov     ecx,msg1_len
        jmp     dump7           ; display error message and exit

dump1:                          ; copy filename from command
                                ; tail to local buffer

        mov     eax,1           ; get pointer to command
        call    argv            ; tail argument in ES:EBX

        mov     ecx,eax         ; let ECX = length
        mov     edi,offset fname; DS:EDI = local buffer address

dump2:  mov     al,es:[ebx]     ; copy filename byte by byte
        mov     [edi],al
        inc     ebx
        inc     edi
```

Figure 1: DUMP.ASM is the source code for the 80386 32-bit protected-mode version of the DUMP utility. DUMP displays the binary contents of a file in hexadecimal and ASCII format.

tage of the fact that we know bit 15 is also the sign bit to control a conditional jump. If you convert this code blindly for 80386 32-bit protected mode, you'd write

```
OR EDX,8000H   ; set flag
.
.
OR EDX,EDX     ; test flag state
JS LABEL1      ; jump if flag set
```

This code will no longer work—bit 31 is the sign bit of EDX, not bit 15! A more portable (though slightly slower) way to write the original code would have been:

```
OR   DX,8000H   ; set flag
.
.
.
TEST DX,8000H   ; test flag
JNZ  LABEL1     ; jump if flag set
```

A related class of problems is caused by code that "looks correct"—seen from the viewpoint of years of 16-bit real-mode programming—but produces unexpected behavior in 32-bit mode. There are several idiosyncracies in Intel's 80386 mnemonics that are especially likely to trip you up in this area. The most notorious offenders are pairs of mnemonics that are both valid in 32-bit protected mode and that implicitly select 16-bit or 32-bit operands. Examples of such pairs are JCXZ and JECXZ, IRET and IRETD, and CWD and CDQ.

CWD and CDQ provide a particularly good illustration of how innocently you can introduce nasty bugs into a previously working program. When CWD is executed in 32-bit mode, it still sign-extends register AX (the low 16 bits of register EAX) into register DX (the low 16 bits of register EDX), leaving the upper 16 bits of the EAX and EDX registers untouched. In most cases, however, what you really wanted was CDQ—which sign-extends EAX into EDX, yielding a 64-bit result.

Another common translation error is overlooking the conversion of a 16-bit index register to the corresponding extended index register. For example, you can easily leave an operand as [BX] when it should really be [EBX]. A program containing this particularly insidious species of bug will usually work fine—until a file buffer

DUMP.ASM 2 of 3

```
        loop    dump2

        mov     ax,ds           ; make our data segment
        mov     es,ax           ; addressable by ES too

                                ; now open the file...
        mov     eax,3d00h       ; Fxn 3DH = open file
                                ; mode 0 = read only
        mov     edx,offset fname; DS:EDX = filename
        int     21h             ; transfer to MS-DOS
        mov     fhandle,eax     ; save file handle if any
        jnc     dump3           ; jump, open successful

        mov     edx,offset msg2 ; open failed, display
        mov     ecx,msg2_len    ; error message and exit
        jmp     dump7

dump3:                          ; read block of file data...
        mov     ebx,fhandle     ; EBX = file handle
        mov     ecx,blksize     ; ECX = record length
        mov     edx,offset fbuff; DS:EDX = buffer
        mov     ah,3fh                  ; Fxn 3FH = read
        int     21h             ; transfer to MS-DOS

        mov     flen,eax        ; save actual length of data
        or      eax,eax         ; end of file reached?
        jne     dump4           ; no, proceed

        cmp     dword ptr fptr,0; was this the first record?
        jne     dump6           ; no, exit normally

        mov     edx,offset msg3 ; display "empty file"
        mov     ecx,msg3_len    ; error message and exit
        jmp     dump7

dump4:  test    fptr,07fh       ; heading needed?
        jnz     dump5           ; jump, not 128-byte boundary

                                ; display heading...
        mov     edx,offset hdg  ; DS:EDX = heading address
        mov     ecx,hdg_len     ; ECX = heading length
        mov     ebx,stdout      ; EBX = standard output handle
        mov     ah,40h          ; Fxn 40H = write
        int     21h             ; transfer to MS-DOS

dump5:  call    cnvblk          ; convert record to ASCII

                                ; display formatted output...
        mov     edx,offset fout ; DX:EDX = output address
        mov     ecx,fout_len    ; ECX = output length
        mov     ebx,stdout      ; EBX = standard output
        mov     ah,40h          ; Fxn 40H = write
        int     21h             ; transfer to MS-DOS

        jmp     dump3           ; go get another record

dump6:                          ; close input file...
        mov     ebx,fhandle     ; EBX = file handle
        mov     ah,3eh          ; Fxn 3EH = close file
        int     21h             ; transfer to MS-DOS

        mov     eax,4c00h       ; Fxn 4CH = terminate,
                                ; return code = 0
        int     21h             ; transfer to MS-DOS

dump7:                          ; common error exit point...
                                ; DS:EDX = message address
                                ; ECX = message length
        mov     ebx,stderr      ; standard error handle
        mov     ah,40h          ; Fxn 40H = write
        int     21h             ; transfer to MS-DOS

        mov     eax,4c01h       ; Fxn 4CH = terminate,
                                ; return code = 1
        int     21h             ; transfer to MS-DOS

dump    endp

cnvblk  proc    near            ; convert record to ASCII

        mov     edi,offset fout ; clear output format
        mov     ecx,fout_len-2  ; area to blanks
        mov     al,blank
        rep stosb

        mov     edi,offset fout ; convert file offset
```

or some other data structure grows larger than 64K. Then the program inexplicably misbehaves or crashes outright.

THE ENVIRONMENT AND COMMAND LINE

Gaining access to command line arguments and to the environment block is always one of the most messy and system-dependent tasks an application program must perform. As I've tried to show in procedures such as ARGC, ARGV, and GETENV that I've previously published in this column for DOS and OS/2, it's best to try and hide the necessary contortions inside subroutines.

The Phar Lap DOS extender passes command-line and environment information through to the 32-bit protected-mode application in the form of two special memory segments that always have the same "hard-wired" selectors. Selector 24h provides addressability to a simulated "program segment prefix" (PSP). This simulated PSP contains a count byte and a

Gaining access to command line arguments and the environment block is one of the most messy and system-dependent tasks an application program must perform.

command tail at offset 80h that can be parsed in the usual manner; most of the other data it contains is either invalid or irrelevant in protected mode. Selector 2Ch provides addressability to the environment block, which is terminated by a pair of null bytes and is followed by the fully qualified name of the program's executable file.

Presumably, when OS/2-386 comes along, an application will obtain selectors

DUMP.ASM 3 of 3

```
        mov     eax,fptr        ; to ASCII for output
        call    d2asc
        xor     ebx,ebx         ; reset buffer pointer

cb1:    mov     al,[fbuff+bx]   ; fetch byte from buffer
        lea     edi,[ebx+foutb] ; point to output area

                                ; format ASCII part...
        mov     byte ptr [edi],'.'; store '.' as default
        cmp     al,blank        ; in range 20H - 7EH?
        jb      cb2             ; jump, not alphanumeric.
        cmp     al,7eh          ; in range 20H - 7EH?
        ja      cb2             ; jump, not alphanumeric.
        mov     [edi],al        ; store ASCII character.

cb2:                            ; format hex part...
        mov     edi,ebx         ; calculate output address
        imul    edi,edi,3       ; (position*3) + base address
        add     edi,offset fouta
        call    b2asc           ; convert byte to hex

        inc     ebx             ; advance through record
        cmp     ebx,flen        ; entire record converted?
        jne     cb1             ; no, get another byte

        add     dword ptr fptr,blksize; update file pointer

        ret                     ; back to caller

cnvblk  endp

_TEXT   ends


_DATA   segment dword use32 public 'DATA'

fname   db      64 dup (0)      ; buffer for input filespec

fhandle dd      0               ; token from PCDOS for input file.

flen    dd      0               ; actual length read

fptr    dd      0               ; relative address in file

fbuff   db      blksize dup (?) ; data from input file

fout    db      'nnnnnnnn'      ; formatted output area
        db      blank,blank
fouta   db      16 dup ('nn',blank)
        db      blank
foutb   db      16 dup (blank),cr,lf
fout_len equ    $-fout

hdg     db      cr,lf           ; heading for each 128 bytes
        db      11 dup (blank)  ; of formatted output
        db      '0  1  2  3  4  5  6  7  '
        db      '8  9  A  B  C  D  E  F',cr,lf
hdg_len equ     $-hdg

msg1    db      cr,lf
        db      'dump: missing file name'
        db      cr,lf
msg1_len equ    $-msg1

msg2    db      cr,lf
        db      'dump: file not found'
        db      cr,lf
msg2_len equ    $-msg2

msg3    db      cr,lf
        db      'dump: empty file'
        db      cr,lf
msg3_len equ    $-msg3

_DATA   ends


STACK   segment dword use32 stack 'STACK'

        dd      64 dup (?)

STACK   ends

        end     dump
```

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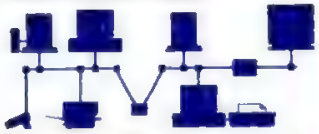
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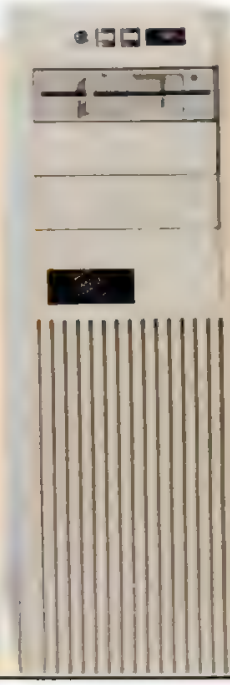
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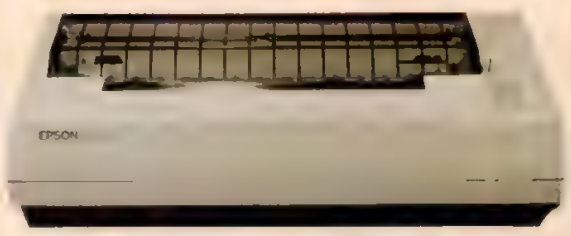
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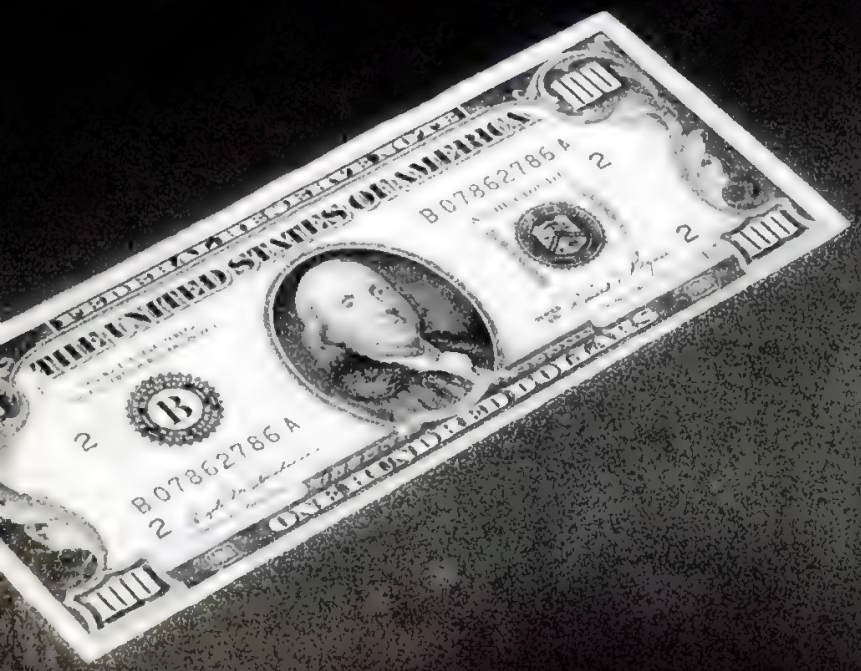
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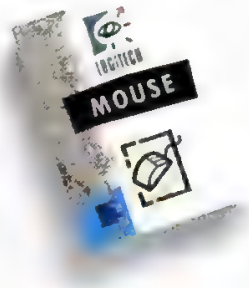
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for the command tail and environment by calling the function DosGetEnv, just as in the current versions of OS/2.

APPLICATION PROGRAM INTERFACE

The 80386 32-bit protected-mode programs that run under the Phar Lap DOS extender invoke the DOS and ROM BIOS services in exactly the same manner that real-mode programs invoke them: by loading registers with the appropriate parame-

ARGC.ASM — **COMPLETE LISTING**

```
        title   ARGC -- count command line arguments
        page    55,132
        .386

; ARGC.ASM:     Return count of command line arguments.
;               Treats blanks and tabs as whitespace.
;
; 80386 version for Phar Lap DOS Extender
; Copyright (C) 1989 Ziff Communications Co.
; PC Magazine * Ray Duncan
;
; Call with:    N/A
;
; Returns:      EAX     = argument count (always >=1)
;
; Uses:         nothing (other registers preserved)
;
; Warning: uses "magic" Phar Lap hard-wired selectors
; to address environment and PSP.  Code will need adjustment
; for other 80386 protected-mode environments.

cr      equ     0dh             ; ASCII carriage return
tab     equ     09h             ; ASCII tab code
blank   equ     20h             ; ASCII space code

pspsel  equ     24h             ; selector for prog seg prefix
cmdtail equ     80h             ; buffer for command tail

_TEXT   segment dword use32 public 'CODE'

        assume  cs:_TEXT

        public  argc
argc    proc    near

        push    ebx             ; save registers
        push    ecx
        push    es

        mov     ebx,pspsel      ; set ES:EBX = command tail
        mov     es,bx
        mov     ebx,cmdtail

        mov     eax,1           ; force count >= 1

argc1:  mov     ecx,-1          ; set flag = outside argument

argc2:  inc     ebx             ; point to next character
        cmp     byte ptr es:[ebx],cr
        je      argc3           ; exit if carriage return
        cmp     byte ptr es:[ebx],blank
        je      argc1           ; outside argument if ASCII blank
        cmp     byte ptr es:[ebx],tab
        je      argc1           ; outside argument if ASCII tab

                                ; not blank or tab...
        jecxz   argc2           ; jump if already inside argument

        inc     eax             ; else found argument, count it
        not     ecx             ; set flag = inside argument
        jmp     argc2           ; and look at next character

argc3:  pop     es              ; restore registers
        pop     ecx
        pop     ebx
        ret                     ; return EAX = argument count

argc    endp

_TEXT   ends

        end
```

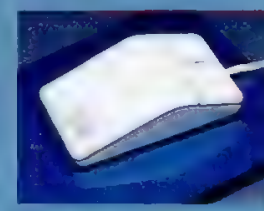
Figure 2: ARGC.ASM, a subroutine that returns the number of command tail arguments. This version is designed for 80386 32-bit application programs that run under the Phar Lap DOS extender.

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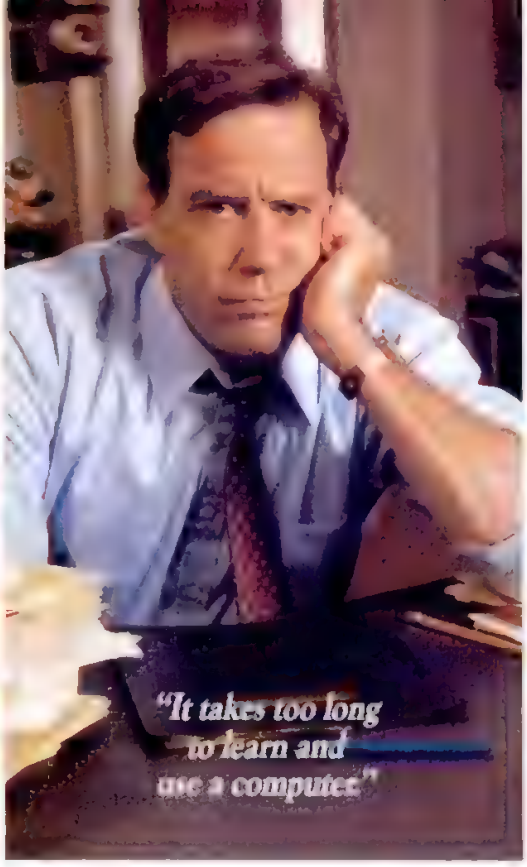
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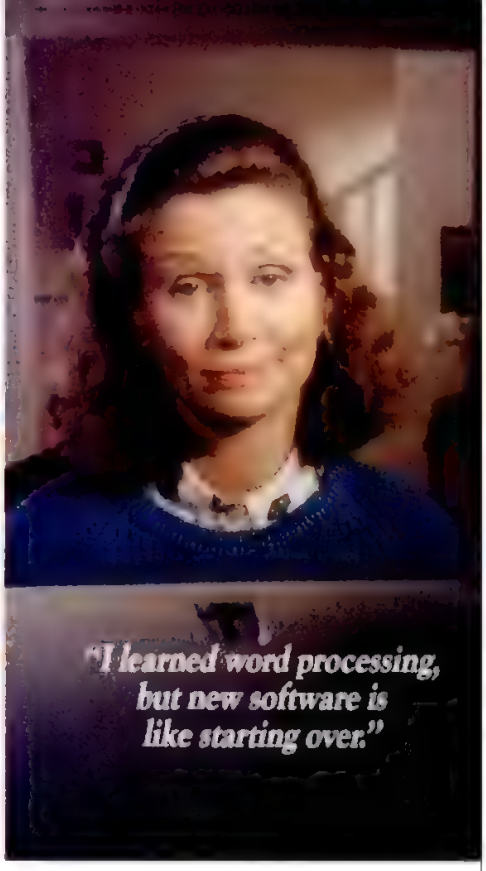
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ters and then executing a software interrupt. This vastly simplifies the conversion of existing real-mode applications because you don't have to learn any new rules to perform console or file I/O! Of course, there is a lot going on behind the scenes in the DOS extender to make such "transparency" possible.

When an application issues a software interrupt, the DOS extender intercepts the interrupt, performs any necessary address translations and/or movement of data between extended memory and conventional memory, switches the CPU into real

ARGV.ASM 1 of 2

```
        title   ARGV --- get address of command line argument
        page    55,132
        .386

; ARGV.ASM:     Return address and length of specified
;               command line argument or fully qualified
;               program name.  Treats blanks and tabs
;               as whitespace.
;
; 80386 version for Phar Lap DOS|Extender
; Copyright (C) 1989 Ziff Communications Co.
; PC Magazine * Ray Duncan
;
; Call with:    EAX     = argument number (0 based)
;
; Returns:      ES:EBX = argument address
;               EAX     = argument length (0=no argument)
;
; Uses:         nothing (other registers preserved)
;
; Note: if called with AX=0 (argv[0]), returns ES:EBX
; pointing to fully qualified program name in environment
; block and EAX=length.
;
; Warning: uses "magic" Phar Lap hard-wired selectors
; to address environment and PSP.  Code will need adjustment
; for other 80386 protected-mode environments.

cr      equ     0dh             ; ASCII carriage return
tab     equ     09h             ; ASCII tab code
blank   equ     20h             ; ASCII space code

pspsel  equ     24h             ; selector for prog seg prefix
envsel  equ     2ch             ; selector for environment block
cmdtail equ     80h             ; buffer for command tail

_TEXT   segment dword use32 public 'CODE'

        assume  cs:_TEXT

        public  argv
argv    proc    near

        push    ecx             ; save registers
        push    edi

        or      eax,eax         ; is it command tail argument 0?
        jz      argv7           ; yes, jump to get program name

        mov     ebx,pspsel      ; set ES:EBX = command tail
        mov     es,bx
        mov     ebx,cmdtail

        xor     ah,ah           ; initialize argument counter

argv1:  mov     ecx,-1          ; set flag = outside argument

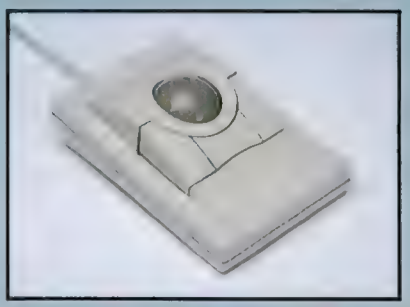
argv2:  inc     ebx             ; point to next character
        cmp     byte ptr es:[ebx],cr
        je      argv6           ; exit if carriage return
        cmp     byte ptr es:[ebx],blank
        je      argv1           ; outside argument if ASCII blank
        cmp     byte ptr es:[ebx],tab
        je      argv1           ; outside argument if ASCII tab

                                ; not blank or tab...
        jecxz   argv2           ; jump if already inside argument
```

Figure 3: ARGV.ASM, a subroutine that returns the address and length of the specified command tail argument. Again, this version is designed to be used in 80386 32-bit application programs that run under the Phar Lap DOS extender.

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ARGV.ASM 2 of 2

```
        inc     ah              ; else count arguments found
        cmp     ah,al           ; is this the one we're looking for?
        je      argv3           ; yes, go find its length
        not     ecx             ; no, set flag = inside argument
        jmp     argv2           ; and look at next character

argv3:                          ; found desired argument, now
                                ; determine its length...
        mov     eax,ebx         ; save param. starting address

argv4:  inc     ebx             ; point to next character
        cmp     byte ptr es:[ebx],cr
        je      argv5           ; found end if carriage return
        cmp     byte ptr es:[ebx],blank
        je      argv5           ; found end if ASCII blank
        cmp     byte ptr es:[ebx],tab
        jne     argv4           ; found end if ASCII tab

argv5:  xchg    ebx,eax         ; set ES:EBX = argument address
        sub     eax,ebx         ; and EAX = argument length
        jmp     argv9           ; return to caller

argv6:  xor     eax,eax         ; set EAX = 0, argument not found
        jmp     argv9           ; return to caller

argv7:                          ; special handling for argv=0
        mov     eax,envsel      ; get environment selector
        mov     es,ax
        xor     edi,edi         ; find the program name by
        xor     al,al           ; first skipping over all the
        mov     ecx,-1          ; environment variables...
        cld

argv8:  repne scasb             ; scan for double null (can't use
        scasb                   ; (SCASW since might be odd addr.)
        jne     argv8           ; loop if it was a single null
        add     edi,2           ; skip count word in environment
        mov     ebx,edi         ; save program name address
        mov     ecx,-1          ; now find its length...
        repne scasb             ; scan for another null byte
        not     ecx             ; convert ECX to length
        dec     ecx
        mov     eax,ecx         ; return length in EAX

argv9:                          ; common exit point
        pop     edi             ; restore registers
        pop     ecx
        ret                     ; return to caller

argv    endp

_TEXT   ends

        end
```

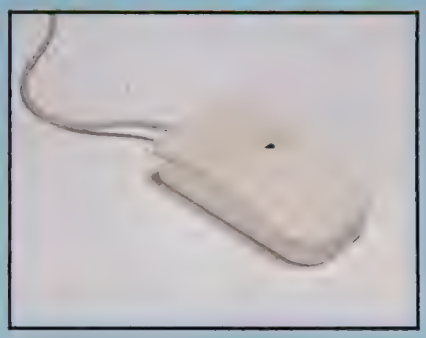
mode, and finally passes the function request onward to DOS or to the ROM BIOS. When the function returns, the DOS extender switches the CPU back into protected mode, carries out any necessary conversions or data movement on the results of the function call, and gives control back to the application.

The application program interface (API) of OS/2-386, when it appears, will use the same model as does the current, 80286 version of OS/2. That's to say, a program will invoke operating system services by pushing parameters on the stack and performing a far call to a named entry point. In fact, OS/2-386 will essentially have two symmetric APIs—one for 16-bit protected-mode applications compiled for 80286 OS/2, and one for 32-bit applications written specifically for 80386 OS/2. It will be up to the developer to decide whether or not to trade the improved performance of 32-bit protected-mode coding for the larger market available to applications that can run on either the 80286 or 80386 versions of OS/2.

THE 80386 DUMP UTILITY

Converting a real-mode DOS application for 80386 32-bit protected mode is really an exceedingly easy undertaking, despite any impressions you might have received to the contrary in this column and the preceding two columns. To give you a practical example of such a conversion, I've translated my hoary old DUMP.ASM util-

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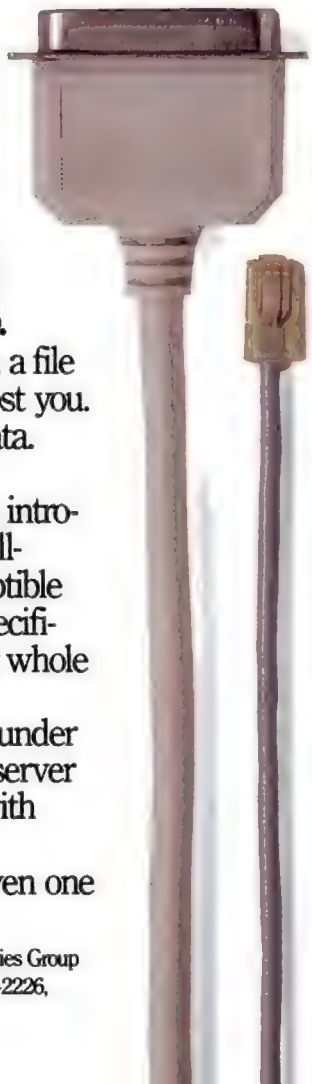
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ity to run in 32-bit protected mode under the Phar Lap DOS extender.

The DUMP utility is used to display the binary contents of a file in hexadecimal and ASCII format on the standard output device. The new DUMP.ASM source code is shown in Figure 1, and you may find it useful to compare it with the real-mode version (contained in my book, *Advanced DOS Programming*, second edition) or with the 16-bit protected-mode version (shown in another one of my books, *Advanced OS/2 Programming*).

The 80386 DUMP.ASM program assembles to a 1,500-byte object file, but since it requires the 132K DOS extender to execute, it's not very memory-efficient as utilities go. However, it does give me the opportunity to provide you with a few useful 80386 subroutine modules: ARGC.ASM in Figure 2, ARGV.ASM in Figure 3, and HEXASC.ASM in Figure 4. ARGC and ARGV provide command tail argument counting and addresses for DOS extender applications. The HEXASC program contains several public routines for converting binary values to hex ASCII strings. The parameters and results of these procedures are documented in the source code listings.

HEXASC.ASM 1 of 2

```
        title   HEXASC -- convert binary to hex ASCII
        page    55,132
        .386

; HEXASC.ASM:   Convert binary data to hex ASCII.
; Copyright (C) 1989 Ziff Communications Co.
; PC Magazine * Ray Duncan
;
; This module contains 3 public routines:
; D2ASC:        Convert binary dword (32-bits) to ASCII string
; W2ASC:        Convert binary word  (16-bits) to ASCII string
; B2ASC:        Convert binary byte  (8-bits)  to ASCII string

_TEXT   segment dword use32 public 'CODE'

        assume  cs:_TEXT

; D2ASC:        Convert doubleword (32-bits) to hex ASCII
;
; Call with:    EAX    = data to convert
;               ES:EDI = storage address for ASCII string
;
; Returns:      nothing
;
; Uses:         EAX, ECX, EDI
;
        public  d2asc
d2asc   proc    near

        push    eax                     ; save copy of dword
        shr     eax,16                  ; convert upper word
        call    w2asc
        pop     eax                     ; get back copy of dword
        call    w2asc                   ; convert lower word
        ret

d2asc   endp

; W2ASC:        Convert word (16-bits) to hex ASCII
;
; Call with:    EAX    = data to convert in lower 16-bits
;               ES:EDI = storage address for ASCII string
;
; Returns:      nothing
;
; Uses:         EAX, ECX, EDI
;
        public  w2asc
w2asc   proc    near

        push    eax                     ; save copy of value
        mov     al,ah
        call    b2asc                   ; convert upper byte
```

Figure 4: HEXASC.ASM is a module that contains several binary-to-hex ASCII subroutines for 80386 32-bit protected mode. D2ASC converts a binary double word (32 bits) into an 8-character hex ASCII string. W2ASC converts a binary word (16 bits) into a 4-character ASCII string. B2ASC converts a byte (8 bits) into a 2-character ASCII string.

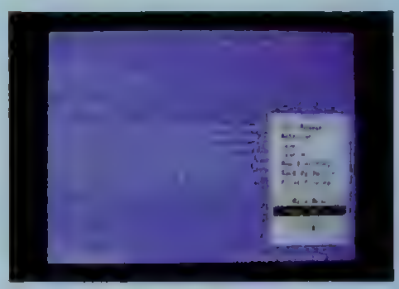
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HEXASC.ASM 2 of 2

```
        pop     eax                     ; get back copy
        call    b2asc                   ; convert lower byte
        ret

w2asc   endp

; B2ASC:        Convert byte (8-bits) to hex ASCII
;
; Call with:    EAX     = data to convert in lower 8-bits
;               ES:EDI  = storage address for ASCII string
;
; Returns:      nothing
;
; Uses:         EAX, ECX, EDI
;
        public  b2asc
b2asc   proc    near

        ror     eax,4
        call    ascii                   ; convert high 4 bits
        stosb                           ; and store ASCII character
        rol     eax,4
        call    ascii                   ; convert low 4 bits
        stosb                           ; and store ASCII character
        ret

b2asc   endp
; ASCII:        Convert nibble (4-bits) to hex ASCII
;
; Call with:    AL      = data to convert in lower 4-bits
; Returns:      AL      = ASCII character
; Uses:         nothing
;
ascii   proc    near

        and     al,0fh                  ; mask to range 00H-0FH
        add     al,'0'                  ; offset to chars '0'-'9'
        cmp     al,'9'                  ; is result > '9'?
        jle     ascii2                  ; no, jump
        add     al,'A'-'9'-1            ; adjust for chars 'A'-'F',

ascii2: ret                             ; return AL = ASCII char.

ascii   endp

_TEXT   ends

        end
```

To assemble and link the DUMP utility using the Phar Lap tools, enter the following series of commands at the DOS prompt:

```
386ASM DUMP
386ASM ARGC
386ASM ARGV
386ASM HEXASC
386LINK DUMP ARGC ARGV
 HEXASC -EXE DUMP
```

The result of the link operation is a file named DUMP.EXP, which is a 80386 32-bit protected-mode executable. You can run this file under the control of the Phar Lap DOS extender with the command line

```
RUN386 DUMP filename.ext
```

where *filename.ext* is the name of the file whose contents you wish to view. If you have licensed the "embeddable" form of the Phar Lap DOS extender, you can build a file named DUMP.EXE that contains both the DOS extender and the actual application. You can do this by entering the command

```
BIND386 RUN386B.EXE DUMP.EXP
```

The file DUMP.EXE may then be distributed and used like any other DOS application, with no clue to the user (other than its size) that it is a true protected-mode program.

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User Defined Help	yes	no	no	no
Telecomm Services	yes	no	no	no
Desk Accessories	yes	no	—	no
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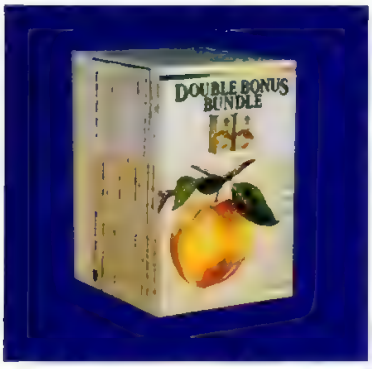
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CIRCLE 358 ON READER SERVICE CARD

by
Douglas Cobb
and Steven Cobb

Spreadsheet Clinic

NAMING WORKSHEETS

For documentation, I keep the name of the worksheet in a cell of each of my *Quattro* worksheets. To do this, I used to type the name as a label. For example, if my worksheet was named TEST.WKQ, I would simply type the label 'TEST.WKQ into a cell of that worksheet. Of course, I had to change the label each time I resaved the worksheet under a new name.

Recently, I found a way to get *Quattro* to "calculate" the name of the worksheet. First, I enter the function

```
A1:  @RIGHT(@CURVALUE("file",
       "save"),14)
```

into any cell of the worksheet (for example, cell A1). Since *Quattro* automatically displays the name of the current worksheet to the right of the Enter file name prompt, when you issue the /File Save command, the function @CURVALUE("file","save") returns that name. For example, if the current worksheet is saved in a file named TEST.WKQ located on the C: drive and in a subdirectory called EXAMPLES, this function will return the string

```
C:\QUATTRO\EXAMPLES\TEST.WKQ
```

The @RIGHT function strips away all but the final 14 characters of that result. In this case, for example, the @RIGHT function would return the string

```
MPLES\TEST.WKQ
```

Next, I enter the function

```
@FIND("\",A1,0)
```

into another cell of the worksheet (for example, A2). This function returns the position of the backslash in the result of the first function. In our example, this function would return the value 5.

Finally, I enter the function

```
@MID(A1,A2+1,12)
```

- **NAMING WORKSHEETS:** Quattro's @CURVALUE function lets you "calculate" the name of a worksheet.
- **ASSIGNING RANGE NAMES:** More ways to name ranges within 1-2-3 macros.
- **TIMED FILE SAVES:** Automatically save all open Excel documents at a specified interval.

into yet another cell (A3, for instance). This function returns the characters to the right of the backslash in the result of the first function. So to continue our example, since the first and second functions have returned the results MPLES\TEST.WKQ and 5, respectively, this final function would return the string TEST.WKQ—the name of the file.

Gerald Dorman and Stephen Einson
Melville, New York

PC MAGAZINE This is just one of the many interesting uses of *Quattro*'s @CURVALUE function. If you wish to do so, you can consolidate Mr. Dorman's three functions into the single function shown below:

```
@MID(@RIGHT(@CURVALUE("file","save")
,14),@FIND("\",@RIGHT(@CURVALUE
("file","save"),14),0)+1,12)
```

Unfortunately, the @CURVALUE function is not available in *1-2-3*.

ASSIGNING RANGE NAMES

I often need to assign a range name in a *1-2-3* macro to the cell on which the cell pointer is positioned. If the range name I want to use is not assigned to another cell or range, I use the statement

```
/rncNAME~~
```

where NAME is the range name I wish to assign. If the name is already assigned to another cell, however, this statement will give the same cell the same name again, rather than assigning it to the cell on which the cell pointer is positioned.

In the September 27, 1988, Spreadsheet Clinic, John Eckenrode suggested using the routine shown in Figure 1 to assign a name (in this case, MARK) to the current cell. The first two statements assure that a range named MARK will not exist when *1-2-3* executes the third statement in the macro. Consequently, the third statement will assign the name MARK to the current cell.

In response, you suggested using the

1-2-3 ROUTINE — COMPLETE LISTING

	A	B	C
1	\a	/rncMARK~~	
2		/rndMARK~	
3		/rncMARK~~	
4			

Figure 1: This three-statement routine assigns the range name MARK to the current cell, even if that name is currently assigned to another cell.

routine shown in Figure 2. If a range named MARK doesn't exist when this macro executes the /Range Name Delete command, the first {OnError} statement will route the macro to the fourth statement, which assigns the range name MARK to the current cell. However, if a range named MARK does exist, the second statement will delete it. Then the macro cancels the first {OnError} command. Since the range name MARK no longer exists, the fourth statement assigns that name to the current cell.

Although both of these techniques work, I use a simpler one shown in Figure 3. This little routine tells *1-2-3* to press the Backspace key after it issues the /Range Name

Spreadsheet Clinic

Create command, types the range name (in this case, MARK), and presses Enter. If the worksheet contains a range named MARK, it will move the cell pointer to that range as soon as *1-2-3* types the name MARK and

1-2-3 ROUTINE COMPLETE LISTING

```
      A          B              C
1   \a         {OnError CONTINUE}
2              /rndMARK~
3              {OnError}
4   CONTINUE   /rncMARK~~
5
```

Figure 2: This routine does the same thing as the one shown in Figure 1.

presses Enter. However, pressing the Backspace key at this point returns the cell pointer to the cell on which it was positioned before the macro issued the command.

1-2-3 STATEMENT COMPLETE LISTING

```
      A          B              C
1   \a         /rncMARK~{BS}~
2
```

Figure 3: Like the macro routines shown in Figures 1 and 2, this statement assigns the name MARK to the current cell. However, it may assign other range names as well.

Consequently, the final tilde (~) assigns the name to the current cell.

Andy Olukalns
Cincinnati, Ohio

Although this method is simpler and faster than the ones that we suggested, it harbors a hidden hazard. If the name you choose is already assigned to a range with more than one name, this routine will assign those names to the current cell as well.

Let's suppose that cell C1 of a *1-2-3* worksheet has the name TEST. If you invoke the macro shown in Figure 3 while the cell pointer is on cell C1, and the range name MARK doesn't exist, *1-2-3* will assign the name MARK to this cell (C1). Now cell C1 has two names: TEST and MARK.

Then suppose that you reinvoke the macro in Figure 3 while the cell pointer is on another cell—E15, for example. As you would expect, *1-2-3* assigns the range name MARK to cell E15. However, it also assigns the name TEST to this cell.

To avoid this hazard, we suggest that you use one of the techniques shown in the September 27, 1988, Spreadsheet Clinic whenever you need to name a range.

TIMED FILE SAVES

Unlike my word processor, *Excel* doesn't automatically save changes being made to open documents at regular intervals. So I created TIMEDSAVE (Figure 4), a macro that saves every document on the workspace at a specified interval.

When you invoke this macro, the first function prompts you to specify the number of minutes between saves. If at this point you decide not to use the macro, simply click Cancel—it will return the value FALSE, and end the execution of the macro. To continue, type a value and click OK. This function will return the number you specified.

Next *Excel* evaluates the functions in cells A4 through A6. The function in A4 tells *Excel* when to save the workspace by returning the serial value of the current date and time and the time increment you specified. The function in A5 commands *Excel* to evaluate the functions in cells A7 and A8 at the time specified by the result of the function in cell A4. And the function in A6 ends the execution of the macro, returning control of the workspace to you.

You can resume your work until the time specified by the result of the function in cell A4. At that time, *Excel* executes the macro, starting with the function in cell A7, which instructs *Excel* to issue the Save Workspace command. This command checks to see which of the open documents have unsaved changes. For each of these documents, *Excel* presents a dialog box that contains three buttons: Yes, No, and Cancel. Clicking on Cancel will end the execution of the macro.

However, if you choose Yes (to save the specified document) or No (not to save your changes), *Excel* loops back to cell A4 as soon as it has saved (or not saved) each open document. At this point it calculates the time when it should next issue the Save Workspace command and returns control to you.

Excel will continue in this fashion until you cancel the execution of the macro by clicking the Cancel button in one of the "Save changes in" alert boxes.

William R. Barnard
Durham, North Carolina

This macro should prove helpful to almost anyone who works with *Excel*. Most users know that they should save their work on a regular basis; however, few people do so as often as they should.

Of course, there will be times when the macro kicks in and you don't want to save any of the documents on the workspace. In these situations, you can click the No button in each of the "Save changes in" dialog boxes. Or, you can use the modified macro shown in Figure 5.

Instead of automatically executing the Save Workspace command when the prescribed time is reached, this macro asks you if it should execute the command. If you click OK, *Excel* lets you save the changes to each document—just as the original macro does. If you click Cancel, however, *Excel* asks whether you want to restart the timer or cancel the macro. If you click OK, *Excel* loops the macro back to cell B4; if you click Cancel, *Excel* cancels the execution of the macro.

Figure 6 shows an automatic file saving macro for *1-2-3*. The first statement in this macro solicits the number of minutes in the save interval and stores your response in the cell named INTERVAL (B13). The second statement in the macro enters the time when the alarm should sound—the

TIMEDSAVE MACRO

```
                                A                                   B
1   TimedSave
2   =INPUT("Number of minutes between automatic backups?",1)
3   =IF(A2=FALSE,HALT())
4   =NOW()+TIME(0,A2,0)
5   =ON.TIME(A4,"SAVE.XLM!R7C1")
6   =RETURN()
7   =SAVE.WORKSPACE()
8   =GOTO(A4)
9
```

Figure 4: This macro automatically saves any open document at the interval you specify.

result of the formula @NOW+INTERVAL/1440—into the cell that is named ALARMTIME (B14).

Statements three through six of the macro constitute a loop. Statement three checks to see if the current time meets or exceeds the "save" time. If it does not, the macro will pause until you press any key. As soon as you do, the macro will enter the macro representation of that key into the cell named KEY (B5). Since KEY is the next cell of the macro, *1-2-3* will execute the keystroke as soon as you type it. Then, *1-2-3* will branch the execution of the macro back to cell B3 and begin another pass through the loop.

1-2-3 will continue testing and looping in this fashion until you press a key at a time that meets or exceeds the time stored in ALARMTIME. At this point, *1-2-3* will break from the loop and present a custom menu with two choices, Yes and No. If you choose Yes, *1-2-3* will return to the READY mode, issue the /File Save command, let you specify a name, and save the worksheet under that name. Then it will branch back to the cell named RESTART (B2), reset the alarm time, and rerun the macro. If you choose No, *1-2-3* will branch back to cell B2 without saving the worksheet.

Since this macro compares the current time with the alarm time whenever you press a key, *1-2-3* processes your keystrokes more slowly while executing this macro. Also, since the macro is running in the background at all times, you won't be able to invoke another macro until you cancel this one. To do so, simply press Ctrl-Break.

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MODIFIED TIMEDSAVE

```
                                  A                                   B
1   TimedSave
2   =INPUT("Number of minutes between automatic backups?",1)
3   =IF(A2=FALSE,HALT())
4   =NOW()+TIME(0,A2,0)
5   =ON.TIME(A4,"SAVE.XLM!R7C1")
6   =RETURN()
7   =ALERT("Execute the Save Workspace command?",1)
8   =IF(A7=TRUE,GOTO(A11))
9   =ALERT("Click OK to restart timer; Cancel to stop macro...",1)
10  =IF(A9=TRUE,GOTO(A4),HALT())
11  =SAVE.WORKSPACE()
12  =GOTO(A4)
13
```

Figure 5: This macro gives you a chance to skip the Save Worksheet command.

TIMEDSAVE FOR 1-2-3 — **COMPLETE LISTING**

```
     A          B                C        D        E        F
1   \s       {GetNumber "Number of minutes between saves? ",INTERVAL}
2   RESTART  {Let ALARMTIME,@NOW+INTERVAL/1440}
3   TEST     {If @NOW>=ALARMTIME}{MenuBranch SAVE}
4            {Get KEY}
5   KEY
6            {Branch TEST}
7
8   SAVE     Yes                 No
9            Save the worksheet? Save the worksheet?
10           {Esc 10}/fs{?}~r{Esc} {Branch RESTART}
11           {Branch RESTART}
12
13  INTERVAL
14  ALARMTIME
15
```

Figure 6: This macro saves your current *1-2-3* worksheet at the interval you specify.

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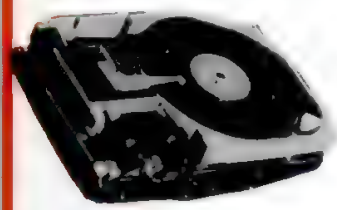
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by
Neil J. Rubenking

User-to-User

PROTECTING IMPORTANT FILES

Although I think the rising fears of viral infection are unwarranted, some INSTALL programs have a deleterious effect on your system, too.

INSTALL programs are useful for novices who may not be aware that boot-up files exist, but such programs often destroy old files while creating short new ones that contain only the lines needed for the software being installed. (This in itself may be responsible for some reports of viruses, as lines needed for other programs mysteriously disappear.) Re-creating an AUTOEXEC file that was trashed or a CONFIG.SYS file containing several device drivers with obscure arguments can be a painful task.

Some sophisticated INSTALL programs will append the necessary lines to your files rather than trashing the originals, but this is an incomplete solution. The lines will be added only to the end of your files, and in some cases the order of device drivers is critical.

The obvious solution is to keep a duplicate of these two files elsewhere on your hard disk. However, if you edit these files often, maintaining a double set of files will take twice the effort.

Since computers are supposed to save effort, it makes sense to keep the files out of reach of other programs rather than to duplicate them. If it is unable to find the files, an INSTALL program will then create its own AUTOEXEC.BAT and CONFIG.SYS, which you can examine and use to edit your own files properly.

The trick is to make your AUTOEXEC.BAT and CONFIG.SYS files reachable by DOS but not by INSTALL programs. This column has previously discussed how to use DEBUG to patch COMMAND.COM in order to change the batch file executed at boot time. The address will vary with the version, but it simply entails locating the string \AUTOEXEC.BAT in COMMAND.COM and replacing it with a new name that may contain a pathname. For example, the name \BAT\AUTO.HID will cause the AUTO.HID file in the subdirectory \BAT to be executed at boot-up.

- PROTECTING IMPORTANT FILES: Hide your AUTOEXEC.BAT and CONFIG.SYS from intrusive INSTALL programs.
- SIMULATING SUBROUTINES: Create the effect of subroutines in your batch files.

The same approach can be taken for the CONFIG.SYS file. Reference to it is made in PC DOS's hidden system file, IBMBIO.COM (IO.SYS for MS-DOS). Again, the location will vary with the version, but the string \CONFIG.SYS can be found toward the end of the file. If, for example, you replace it with the string \SYS\CO.HID, the CO.HID file in the subdirectory \SYS will be used instead of a CONFIG.SYS file in the root directory. Care must be taken when editing a system file, however, that it is written back to the exact same location on the disk. This is automatic for most byte-level editors.

William R. Peate
Houston, Texas

Yes, it's possible to get *everything* out of your root directory except the two hidden system files, IBMDOS.COM and IBMBIO.COM (or MSDOS.SYS and IO.SYS for MS-DOS). When your system boots, the boot sector executes first and it loads IBMBIO.COM and IBMDOS.COM. IBMBIO.COM then reads CONFIG.SYS. If CONFIG.SYS contains a SHELL= line, this statement determines what gets loaded as a command processor—usually COMMAND.COM, which, in turn, loads and runs the AUTOEXEC.BAT file. Now your system is ready to run.

To use another file instead of AUTOEXEC.BAT, you must patch COMMAND.COM, but this isn't hard. To use a COMMAND.COM in a different location, you just put a simple SHELL= statement in CONFIG.SYS and a SET COMSPEC= line in AUTOEXEC.BAT. But to use a different filename for CONFIG.SYS, you have to patch IBMBIO.COM—and that's dangerous work. Do it wrong, and your computer may fail to boot from the hard disk. Don't try this unless you're a DEBUG whiz.

Before you are able to operate on IBMBIO.COM, you have to make it editable. It's normally marked as Read-Only, Hidden, and System—any one of these attributes will keep you from editing it. But a utility like *PC Magazine*'s ATTR.COM will remove these attributes. Load it into DEBUG and search for the string CONFIG.SYS. Replace this with a new string of the same length, such as SYS\CO.HID. Write the changed file to disk, then use ATTR.COM to restore the original attributes.

There is one disagreeable side-effect of this change—you'll have trouble when you want to create bootable floppies. Both the SYS command and FORMAT /S copy IBMBIO.COM and IBMDOS.COM from the boot disk to the floppy, and they'll be copying your patched version. You have two choices: you can create a subdirectory for CONFIG.SYS on every such floppy, or you can keep a blank system-formatted floppy around and DISKCOPY from it as needed.

SIMULATING SUBROUTINES

I needed a way to call a subroutine from within a batch file. I knew about spawning another batch file and I knew about chaining from one batch file to another. I've even read about the batch CALL statement that's available in DOS 3.3. However, spawning, CALLing, and chaining all require using a separate batch file. I wanted a way to keep the subroutine in the same file as the main

routine and to be able to pass parameters to it.

After looking through the DOS manual, I realized that there was no easy way to accomplish what I wanted, so I decided to "trick" DOS into doing the equivalent of a subroutine call.

SUBTEST.BAT, which is shown in Figure 1, illustrates the method that I used. (This batch file contains line numbers for purposes of explanation only; they should not be included in your own batch files).

Lines 1 through 6 are general header instructions. Line 7 branches to the label that exactly matches the first parameter on the command line (in this case, either MAIN1 or MAIN2; upper- and lowercase are equivalent).

SUBTEST.BAT COMPLETE LISTING

```
1     ECHO OFF
2     REM Batch file to illustrate
            internal subroutines.
3     REM Usage:
4     REM C> SUBTEST MAIN1
5     REM C> SUBTEST MAIN2
6
7     GOTO %1
8
9     :main1
10    ECHO Entered MAIN1 routine
11    SET arg=Arg #1
12    SET rtn1=main1rtn
13    GOTO sub1
14    :main1rtn
15    ECHO Returned from SUB1 to
            MAIN1RTN
16    GOTO done
17
18    :main2
19    ECHO Entered MAIN2 routine
20    SET arg=Arg #2
21    SET rtn1=main2rtn
22    GOTO sub1
23    :main2rtn
24    ECHO Returned from SUB1 to
            MAIN2RTN
25    GOTO done
26
27    :sub1
28    ECHO Entered SUB1 routine
            with arg = %arg%
29    SET rtn2=sub1rtn
30    GOTO sub2
31    :sub1rtn
32    ECHO Returned from SUB2 to
            SUB1RTN
33    GOTO %rtn1%
34
35    :sub2
36    ECHO Entered SUB2 subroutine
37    GOTO %rtn2%
38
39    :done
40    SET rtn1=
41    SET rtn2=
```

Figure 1: This batch file simulates subroutine calls by storing a "return address" and jumping to that address at the end of the subroutine.

Lines 9 through 16 and 18 through 25 are the two main routines. Other than using a different value for the *arg* parameter, they are equivalent. The description of MAIN1 therefore applies to MAIN2 as well. Line 11 specifies a value for the *arg* parameter (remember not to leave a space after the equals sign, as it would be included in the value).

Lines 12 through 14 implement the simulated GOSUB. Line 12 sets up the label to which we will return after executing the subroutine. (Again, remember that you can't include a space after the equals sign.) Line 13 branches to the subroutine, and line 14 is the return label to the next line in the batch file.

Lines 27 to 33 represent a subroutine. A few points are worth noting. Line 28 shows that you can use arguments passed through an environment string. Lines 29 to 31 implement a second simulated GOSUB. The environment variable used for the second return label (RTN2) *must* be different from the one used to enter SUB1 (RTN1). Line 33 is the simulated RETURN statement.

Lines 35 to 37 represent the second subroutine. And lines 39 to 41 wrap up the batch file. It is important to clean up the environment before terminating the batch file, as lines 40 and 41 do.

Although I've used this technique with only DOS 3.2, I think it would work with other 3.*x* versions as well. It does use valuable environment space, so you might have to increase the size of your environment to take advantage of this method.

Roger Crowley
Great Mills, Maryland

The batch file SUBTEST works fine even in DOS 2.0—it's not using any special features of DOS 3.*x*. To simulate a GOSUB in a batch file, you store the return address, jump to the subroutine, execute the subroutine's instructions, and jump to the stored return address. A subroutine call in a high-level language does exactly the same thing, but it happens behind the scenes.

Items that appear in this column often point out that even the tiniest batch file takes at least one cluster—2K to 4K—of disk space. Thus, in order to save space you can combine many batch files into one and select which ones to run, using a command-line parameter.

But what do you do if some of the batch files that you've combined need to call each other? Treating each of the batch files as if it were a subroutine makes it possible for one to call another.

SUBTEST2.BAT COMPLETE LISTING

```
ECHO OFF

GOTO %1

:main1 SUBROUTINE
ECHO Entered MAIN1 routine
SET arg=Arg #1
CALL subtest2 sub1
ECHO Returned from SUB1 to
   MAIN1RTN
GOTO RETURN

:main2 SUBROUTINE
ECHO Entered MAIN2 routine
SET arg=Arg #2
CALL subtest2 sub1
ECHO Returned from SUB1 to
   MAIN2RTN
GOTO RETURN

:sub1 SUBROUTINE
ECHO Entered SUB1 routine with
   arg = %arg%
CALL subtest2 sub2
ECHO Returned from SUB2 to
   SUB1RTN
GOTO RETURN

:sub2 SUBROUTINE
ECHO Entered SUB2 subroutine
GOTO RETURN
:RETURN
```

Figure 2: This batch file simulates subroutine calls by re-calling itself with different command-line arguments.

Do note that there's another way to get the effect of subroutines. I've illustrated it in Figure 2. To call a subroutine, you just re-call the main batch file with that subroutine's name as the first argument. At the top of the batch is the line GOTO %1—it jumps directly to the label specified as argument 1. After each subroutine there's a GOTO RETURN, where RETURN is at the end of the file.

This second method uses fewer batch lines and less environment space. However, it's slightly slower, due to reloading the whole batch file again and again. Either method helps you keep the number of small batch files to a minimum.

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edited by
Craig L. Stark

Power User

"WINDOWING" SIDEKICK FILES

When using *SideKick*'s Notepad, it's often useful to be able to view another file without first having to save your current file. The program's telephone directory provides a useful shortcut.

Go to Setup (F7 on the *SideKick* menu), make sure there is no default filename or directory in the Telephone Directory section, and save the Setup information to disk. From now on, pressing Alt-D while in the Notepad will bring up the Dialer, showing the file directory window. From here you can select the file you want to view. While working within the Dialer, you can use the F6 option to search for the section that you want to see.

Kerwin T. Fernandez
Dagupan City, Philippines

PC MAGAZINE To expand the Notepad's capabilities still further, you can use the import data command to copy text from the Dialer to the Notepad. After calling up the second file as Mr. Fernandez suggests, hit Alt-N to go back to the Notepad, then F4 to import data. Next, mark the text to import from the Dialer window (using Ctrl-KB to begin the block and Ctrl-KK to end the block) and import the text with the Ctrl-KC command.—*M. David Stone*

ACCESSING WORD FAST

Microsoft Word can take a long time to load if you have a large glossary. On my IBM portable computer (with an 8088 CPU), the process can take close to one and a half minutes. Usually the wait is worth it, but sometimes you may need to load *Word* in a hurry, to print a file or to make that one last little change.

When you're in a rush, try using this batch file:

```
ren c:\word\normal.gly *.gli
word /1
ren c:\word\normal.gli *.gly
```

QW.BAT renames the standard glossary, NORMAL.GLY, to NORMAL.GLI before loading *Word*, so there is no glossary for *Word* to load. When you leave *Word*, QW.BAT renames NORMAL.GLI back to NORMAL.GLY. On my IBM portable, this saves 64 seconds in loading *Word*.

Michael A. Kagan
Fayetteville, New York

PC MAGAZINE I timed this on a 4-MHz XT and a 12-MHz AT clone and found the results to be less dramatic, but still significant. The XT loaded *Word* in 25 seconds with the glossary, and about 10 seconds without it. The AT clone managed about 6.5 seconds with the glossary and about 2.5 seconds without it. Even with the AT, the difference is enough to make *Word* far more tolerable for applications such as repeatedly modifying and testing a batch file.

There is a drawback to loading *Word* without NORMAL.GLY; the macros and text entries you usually depend on will not be available. One compromise is to create a QW.GLY with one macro:

```
<esc>tgmc:\word\normal.gli<enter>
```

This macro uses the Transfer Glossary Merge command to load NORMAL.GLI. Next, change QW.BAT to

```
ren c:\word\normal.gly *.gli
ren c:\word\qw.gly normal.gly
word /1
ren c:\word\normal.gly qw.gly
ren c:\word\normal.gli *.gly
```

In this version, the very short QW.GLY is renamed to NORMAL.GLY before loading *Word* and renamed back to QW.GLY after leaving the program. The glossary adds almost no time to loading *Word*, but should you find yourself in *Word* and needing your usual macros, you can then load them quickly and easily. When you leave *Word*, be sure to answer no when *Word* prompts: Enter Y to save glossary, N to lose edits.—*M. David Stone*

PRINTING THE SCREEN

Printing the current screen by hitting Shift-PrtSc is often convenient, but the printed output is "down and dirty"—with no boldfacing or other formatting to differentiate headings, totals, and so forth.

In *dBASE III*, however, you can send escape sequences directly from the screen so the output is nicely formatted. All you need do is to display them to the screen along with your data. Shift-PrtSc then sends them as an integral part of the data, and the printer responds accordingly.

Of course, actually *seeing* all those escape sequences on the screen would be distracting. So before you display them, just use the SET COLOR TO command to set the foreground color to be the same as the background. The example shown in Figure 1 is for a monochrome screen, but any color scheme can be used.

Robert A. Swirsky
Cold Spring Harbor, New York

- "WINDOWING" SIDEKICK FILES: Here's a quick way to view a second text file using SideKick's Notepad.
- ACCESSING WORD FAST: It's quicker to load Microsoft Word without the glossary—but not necessarily better.
- PRINTING THE SCREEN: How to send printer escape sequences in dBASE III when using Shift-PrtSc.
- CLEAN UP dBASE ENTRIES: Automatically make inconsistent database entries uniform.

INVISIBLE ESCAPE SEQUENCES — **COMPLETE LISTING**

```
CLEAR
SET COLOR TO N/N                        && invisible
@ 0,0 SAY CHR(27)+":"                   && 12-point type
?? CHR(27)+"E"                          && boldface on
SET COLOR TO W/N                        && visible
@ 1,35 SAY "Screen Heading"
SET COLOR TO N/N                        && invisible
?? CHR(27)+"F"                          && boldface off
SET COLOR TO W/N                        && visible
*
*  (display rest of screen)
```

Figure 1: This program segment demonstrates how to make escape sequences invisible. Now hitting Shift-PrtSc will send formatting instructions to your printer along with the data, but it will not display them on the screen.

This solution works with any printer and has the added charm of simplicity. Other controls, such as extra line feeds, can also be sent. You can even add text, which becomes invisible on the screen but will appear on the printed record.

Naturally, anything simple has limitations. The formatting sequences, though not visible, will take up room on the screen—especially if you're using the HP PCL. If you get carried away, you may have to compromise between the screen appearance and printout appearance.

Line 0 is usually a good place to put the initial printer setup strings, but if you use it, remember to SET SCOREBOARD OFF before CLEARing the screen. This ensures that all of line 0 is available to you.

If you switch font sizes, the screen and printout will be spaced differently. Further, you have to remember to turn off everything you turn on. And you have to be careful not to overwrite the sequences with later screen writes.

Incidentally, the technique of setting the foreground and background to the same color is also useful when entering passwords, since passersby cannot see what the user entered.—*Brad Stark*

CLEAN UP dBASE ENTRIES

The INDEX UNIQUE command is very useful to make inconsistent entries in certain database fields consistent. This problem frequently arises, for example, when two users type different abbreviations for the same city. New York could end up in the file as NYC, N.Y., NY, or even Manhattan. Since you often need geographic information, the city field must be made uniform. Here are the steps I follow to clean it up:

```
INDEX UNIQUE ON City TO temp
LIST OFF FIELD City TO PRIN
```

This produces an alphabetized list of every unique city in the file. Then I scan the list, marking those that need to be consolidated. Next, I write a simple program to replace the bad abbreviations that has one line per change. For example,

```
REPL ALL city WITH "New York" FOR
 city="NYC"
REPL ALL city WITH "New York" FOR
 city="N.Y."
REPL ALL city WITH "New York" FOR
 city="NY"
```

Unfortunately, if you have a large file or many changes, you'll want to run the program during lunch or overnight.

Robert O. Banziger
Batavia, Ohio

Uniformity is a universal problem that faces database users, and this straightforward approach works fine unless the file is very large.

Figure 2 is a somewhat more complex technique, but it executes much faster on a big database. In Step 1, you start by creating a lookup database with one record for each unique city. In MODIFY STRUCTURE, you add a second field (for example, City2) that has the same Type and Length as the original field. After saving the new structure by hitting Ctrl-W and then the Enter key, each City2 field is REPLACEd with the contents of the original City field, so the new lookup file now has two identical fields.

In Step 2, you BROWSE through the lookup file, making the desired changes in the City2 field, so the two fields effectively reflect the changes you want.

Since you have *not* changed any of the original City fields, every City field in the original database should have a matching City in the lookup file. Your only interest, however, is in those lookup records where you have changed City2. So the unchanged lookup records are deleted and the remaining lookup records are indexed on the City field. The SET RELATION TO command then links the two files together so the final processing can take place in Step 3, in which all the original City fields that require changing can be REPLACEd from the lookup file's City2 field.—*Brad Stark*

MAKING ENTRIES CONSISTENT

```
* Step 1
INDEX UNIQUE ON City TO temp
COPY FIELD City TO lookup
SELECT B
USE lookup
MODIFY STRUCTURE
REPL ALL City2 WITH City
* Step 2
BROWSE
DELE FOR City=City2
PACK
INDEX ON City TO lookup
SELECT A
SET RELATION TO City INTO B
* Step 3
REPL ALL City WITH b->City FOR
 b->City>" "
```

Figure 2: A *dBASE III* technique to make the fields of a large database uniform.

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edited by
Tony Rizzo

Languages

SOLVING A PROGRAMMING PUZZLE ON PC MAGNET

The following slightly edited conversation recently took place on PC MagNet's Programming Forum, where a forum participant posed a puzzle, and our assembly language programming wizard, Michael Mefford, supplied several solutions, with each subsequent solution being more efficient than the preceding one.

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Fm: David Stafford [BORLAND]
76666,2542
To: All
Does anyone remember the neat trick to tell if a register has ONE and ONLY ONE bit set? No looping necessary.

It's a very interesting problem and I think the programmers on this forum are the type who enjoy logic puzzles like this one. I spent quite some time trying to solve it and the answer didn't pop into my head until I had almost given up. Once you discover the answer it seems "obvious" and you wonder how stupid you could have been not to have seen it in the first place!

Fm: Michael J. Mefford [PCMAG]
72241,161
To: David Stafford [BORLAND]

```
mov  bx,ax
sub  bx,1
jb   no_ones
and  bx,ax
jnz  more_than_one
```

Otherwise only one bit.

Fm: Neil Rubenking [PCMAG]
72241,50
To: Michael J. Mefford [PCMAG]
How come that works? Is it what David had in mind?

Fm: James Curran 72261,655
To: Neil Rubenking [PCMAG]
The basic concept is that any binary number with just one bit set produces a number with all the lower bits set when 1 is subtracted (001000 - 1 = 000111, for example). ANDing these numbers together always produces 0. A number with more than one bit set won't work (010100 - 1 = 010011. 010100 & 010011 = 010000). The only exception is a starting number of 0, which also results in zero (00000 - 1 - 11111. 00000 & 11111 = 00000). So, the first test checks for zero, and then he does the AND.

- **SOLVING A PROGRAMMING PUZZLE ON PC MAGNET:** How you can determine if only one bit is set in a register.
- **UTILIZE BASIC'S PLAY COMMAND:** Exploiting BASIC's PLAY command could brighten someone's day.
- **GRAPHICS SCREEN DUMPS:** Work with the Borland Graphic Interface to get Turbo Pascal graphics screen dumps in any mode.

Fm: Michael J. Mefford [PCMAG]
To: Neil Rubenking [PCMAG]
Assume that AX has the value in question.

```
mov bx,ax
sub bx,1
jb  no_ones
and ax,bx
jnz more_than_one
```

otherwise only one bit.

The jump if carry after subtracting 1 branches on the special case of a zero value in ax, no bits set. But it also sets up for the second test for one bit. If it gets past this zero test, then there has to be at least one bit set. If there is only one bit, then subtracting one clears that bit due to a borrow and sets all of the lower bits. The result of ANDing with the original value results in zero. If more than one bit is set, subtracting one does not clear the highest bit. Therefore ANDing with the original value does not result in zero.

Now that I think about it, a slightly more efficient solution would be

```
mov bx,ax
dec bx
js  not_one_bit
and ax,bx
jnz not_one_bit
```

Fm: David Stafford [BORLAND]
To: Michael J. Mefford [PCMAG]
Yes—that's the idea. Now, can you figure out a way to eliminate the explicit test for zero? It can be done on the 8086.

Fm: Michael J. Mefford [PCMAG]
To: David Stafford [BORLAND]

```
mov bx,ax
dec bx
or  ax,8000h
and ax,bx
jz  one_bit
```

Fm: David Stafford [BORLAND]
To: Michael J. Mefford [PCMAG]
That doesn't look right. What if ax is 8000h?

Fm: Michael J. Mefford [PCMAG]
To: David Stafford [BORLAND]

```
                ; ax=8000h  bx=?
mov bx,ax       ; ax=8000h  bx=8000h
dec bx          ; ax=8000h  bx=7FFFh
or  ax,8000h    ; ax=8000h  bx=7FFFh
and ax,bx       ; result  = 0
jz  one_bit     ; one_bit = TRUE
```

Fm: David Stafford [BORLAND]
To: Michael J. Mefford [PCMAG]

Sorry! Yes, that works fine. In fact, it is a better solution than the one I had in mind (it isn't machine dependent).

.
.
.

—Edited by Tony Rizzo

UTILIZE BASIC'S PLAY COMMAND

If you would like to give your secretary or colleague a little surprise on his or her birthday, the short program shown in Figure 1 will play the Happy Birthday song. Simply place the command BASIC BIRTHDAY in his AUTOEXEC.BAT file when the person in question is not looking and, when he boots up on his birthday, this program will play the cheery tune. It's sure to brighten his day!

The BASIC language interpreter that comes with some computers is named GW-BASIC and, of course, in this case you should use that name in the batch file instead.

Jose Da Rosa
Seattle, Washington

PLAY is one of BASIC's most underused commands, perhaps because it requires at least a minimal understanding of musical notes. This is unfortunate, because short tunes can do a lot to perk up an otherwise humdrum application. The PLAY command statements comprise a complete minilanguage that lets you control each note's pitch and duration, as well as the overall tempo. Perhaps your tune will inspire others to follow suit. One of my personal favorite PLAY tunes is the Ms. Packman theme:

```
PLAY
 "mll16o2cdecl8dfl
 16efgel8dfl16efge
 fgabmnl8>c<b>l4c"
```

—Ethan Winer

BIRTHDAY.BAS COMPLETE LISTING

```
' ***** BIRTHDAY.BAS *****

100 CLS
110 Person$ = "Vickie"
120 Birthday$ = "06-12-1989"
130 IF Birthday$ <> DATE$ THEN
  SYSTEM
140 PRINT TAB(5); "Happy
  birthday to you . . ."
150 PLAY "o3 c8 c8 d c f e2"
160 PRINT TAB(10); "Happy
  birthday to you . . ."
170 PLAY "c8 c8 d c g f2"
180 PRINT TAB(15); "Happy
  birthday dear "; Person$; "..."
190 PLAY "c8 c8 o4 c o3 a f e d2"
200 PRINT TAB(20); "Happy
  birthday to YOU!!"
210 PLAY "t90 b-8 b-8 a f g f2"
```

Figure 1: When this little BASIC program is run it will play "Happy Birthday." Place it in someone's AUTOEXEC file on that person's birthday.

GRAPHICS SCREEN DUMPS

I frequently produce graphics with Borland's Turbo Pascal 4.0. Normally I prefer sending the results to a plotter; however, a plotter isn't always available. Instead, I have devised a simple procedure to dump the screen contents to an Epson or IBM printer. Although it may not be high quality, it is quick.

The procedure SCRDMP in the program SCRNDUMP.PAS, shown in Figure 2, takes each pixel from the screen and produces a corresponding dot on the printed output. The heart of the routine is the GetPixel function in the GRAPH unit, which gives us access to the screen image regardless of the graphics adapter. You must, of course, be in graphics mode and be using a supported graphics adapter. The image will vary in size depending on the

SCRNDUMP.PAS 1 of 2

```
UNIT ScrnDump;
{   Written by: Thomas L. Bregante, 1988 }

INTERFACE

USES
  Graph,
  Printer;

CONST
  EpsonFx = 1;
  IBMGR = 2;
  IBMPRO = 2;

  PROCEDURE Scrdmp(PrinterType : Byte);

IMPLEMENTATION

  PROCEDURE Scrdmp(PrinterType : Byte);
  CONST
    Esc = $1B;
  VAR
    X, I, X, Y : Integer;
    Pins, Pin, Bcolor : Byte;
    Vlimit, Hlimit, Vextra, Klimit : Integer;

    PROCEDURE InitLine(Columns : Integer);
      { Setup for double density graphics}
    VAR
      ColMod, ColDiv : Byte;
    BEGIN
      ColDiv := Columns DIV 256;
      ColMod := Columns MOD 256;
      Write(lst, Char(Esc), 'L', Char(ColMod), Char(ColDiv));
    END;

    PROCEDURE SetPrinter(Ptype : Byte);
      { Set to 8/72 inches per line}
    BEGIN
      CASE Ptype OF
        1 : WriteLn(lst, Char(Esc), 'A', Char(8));
        2 : WriteLn(lst, Char(Esc), 'A', Char(8), Char(Esc), '2');
      END;                              (* Case *)
    END;

    PROCEDURE ResetPrinter(Ptype : Byte);
      { Set to 6 lines per inch and sent a form feed. }
    BEGIN
      CASE Ptype OF
        1, 2 : WriteLn(lst, Char(Esc), '2', Char(12));
      END;                              (* Case *)
    END;
```

Figure 2: The procedure SCRDMP uses the .BGI file to print a screen dump of a graphics image regardless of which video adapter is in use.

SCRNDUMP.PAS 2 of 2

```
BEGIN
  SetPrinter(PrinterType);
  Bcolor := GetBkColor;
  Hlimit := GetMaxX;
  Vlimit := GetMaxY DIV 8;
  Vextra := GetMaxY MOD 8;
  Klimit := 7;
  FOR I := 0 TO Vlimit DO
    BEGIN
      InitLine(Hlimit+1);
      FOR X := 0 TO Hlimit DO
        BEGIN
          Pins := 0;
          IF I = Vlimit THEN Klimit := Vextra;
          FOR K := 0 TO Klimit DO
            BEGIN
              Y := (I*8)+K;
              Pin := GetPixel(X, Y);
              IF Pin <> Bcolor THEN {Compare to background}
                Pins := Pins+1 SHL (7-K); {Calc power of 2}
            END;
          Write(lst, Char(Pins));
        END;
      WriteLn(lst);
    END;
  ResetPrinter(PrinterType);
END;                              {SCRDMP}

END.
```

The heart of the routine is the GetPixel function in the GRAPH unit, which gives us access to the screen image regardless of the graphics adapter.

graphics adapter (the CGA image has about half the pixels of the EGA image). I've found the printed picture is suitable for use in a laboratory notebook.

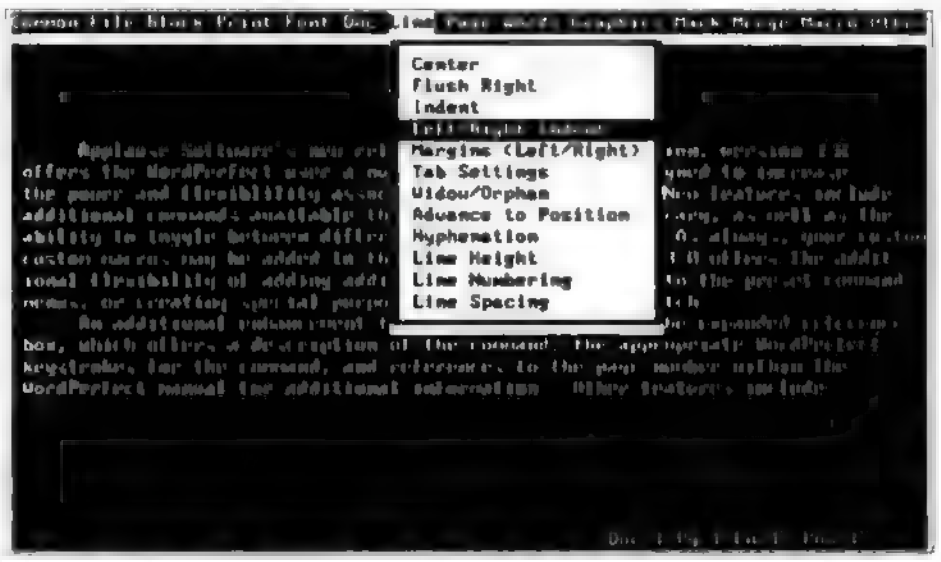
The program SCRNTEST, shown in

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PM109

Languages

SCRNTEST.PAS — COMPLETE LISTING

```
PROGRAM ScrnDumpTest;
{ Author: Thomas L. Bregante, 1988 }

USES
  Crt,
  Graph,
  ScrnDump; {ScrnDump uses the Graph Unit}

VAR
  GraphDriver, GraphMode : Integer;
  X, Y, MaxX, MaxY : Integer;
  I, ErrorCode : Integer;
  Ch : Char;
  PrinterType : Byte;

BEGIN
  ClrScr;
  WriteLn('1  Epson FX Printer');
  WriteLn('2  IBM Graphics Printer');
  WriteLn('3  IBM Proprinter');
  WriteLn;
  Write('What Type of printer do you have (1, 2 or 3) ? ');
  X := WhereX;
  Y := WhereY;
  REPEAT
    GotoXY(X, Y);
    Ch := ReadKey;
    Write(Ch);
  UNTIL (Ch > '0') AND (Ch < '4');
  CASE Ch OF
    '1' : PrinterType := EpsonFx;
    '2' : PrinterType := IBMGR;
    '3' : PrinterType := IBMPRO;
  END;                                  {Case}
  GraphDriver := Detect;
  InitGraph(GraphDriver, GraphMode, '');
  ErrorCode := GraphResult;
  IF ErrorCode <> GrOK THEN
    BEGIN
      WriteLn;
      WriteLn('ERROR: ',GraphErrorMsg(ErrorCode));
      Halt;
    END;
  MaxX := GetMaxX;
  MaxY := GetMaxY;
  FOR I := 0 TO 9 DO                    {draw boxes}
    Rectangle(10*I, 10*I, MaxX-10*I, MaxY-10*I);
  SetTextStyle(DefaultFont, HorizDir, 1);
  OutTextXY(250, MaxY DIV 2, 'Add Some Text and Dump');

  ScrDmp(PrinterType);                  { Dump It }
  CloseGraph;
END.
```

Figure 3: The program SCRNTEST demonstrates the screen-printing abilities of the ScrnDump Unit, shown in Figure 2. The quality isn't great, but it is quick.

Figure 3, shows SCRDMP in action. The appropriate .BGI file must be available when the program is run.

Thomas L. Bregante
Union City, California

With some of the new features added in Turbo Pascal 5.0, your program can now search for the .BGI files anywhere on your path. The function GraphPath, shown in Figure 4, returns the path to the .BGI files if it can find them. When its search fails, it asks the user for a pathname. To incorporate GraphPath into the SCRNTEST program, add DOS to the USES clause, insert the GraphPath function in the code, and put "GraphPath" instead of a null string in the InitGraph procedure.

This particular demo works, but it's possible that certain graphic images will not print for you. The problem is, in Versions 4.0 and 5.0, the Printer Unit initializes the Lst device in "cooked" mode, meaning that it interprets control characters. In particular, it interprets character

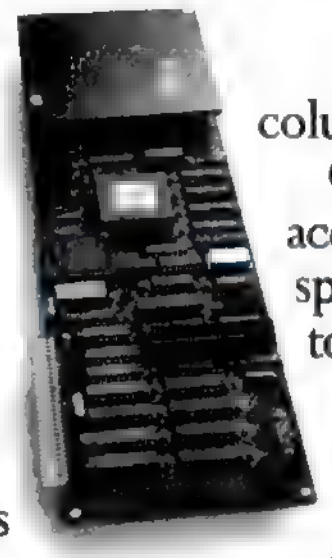
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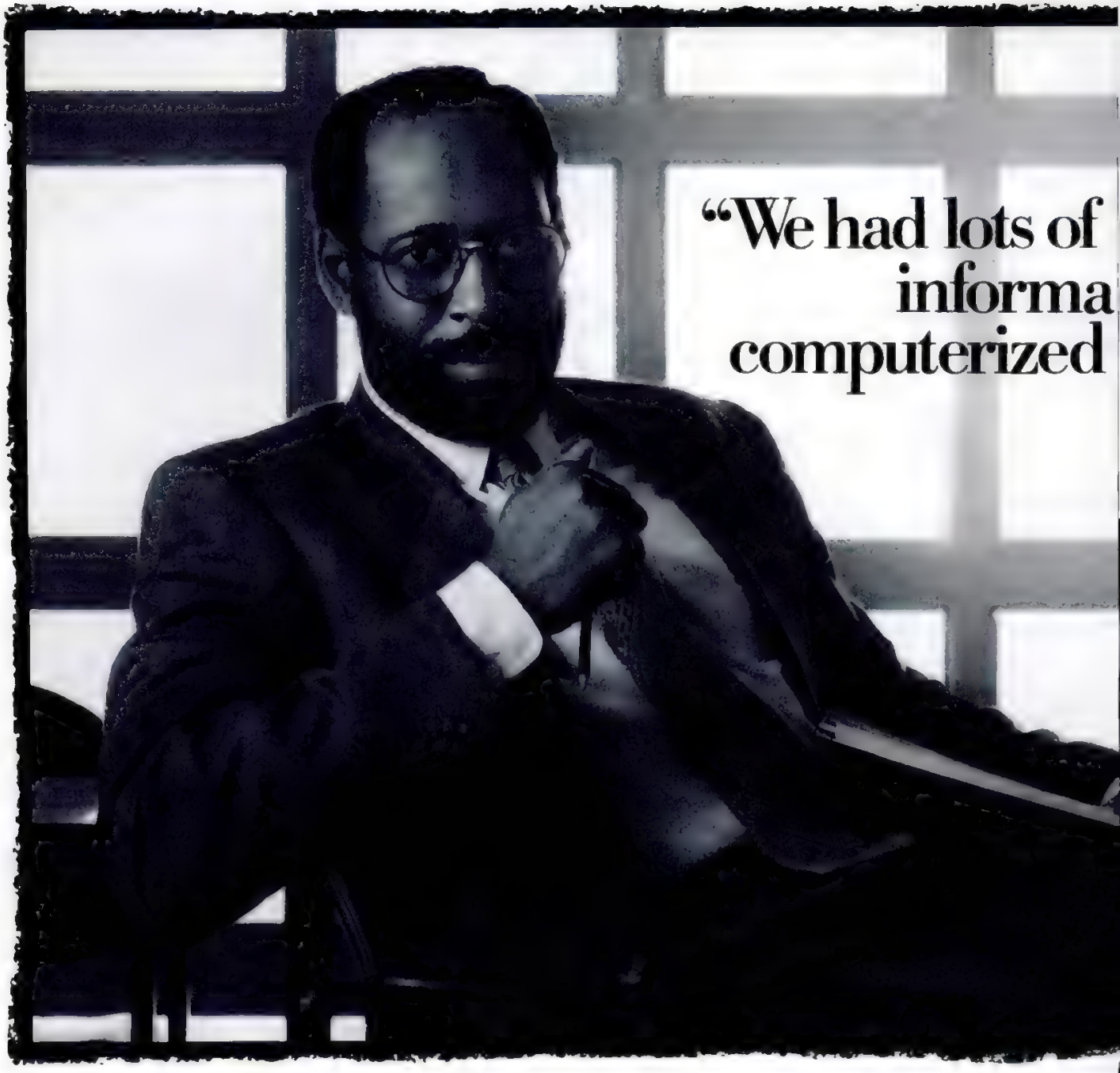
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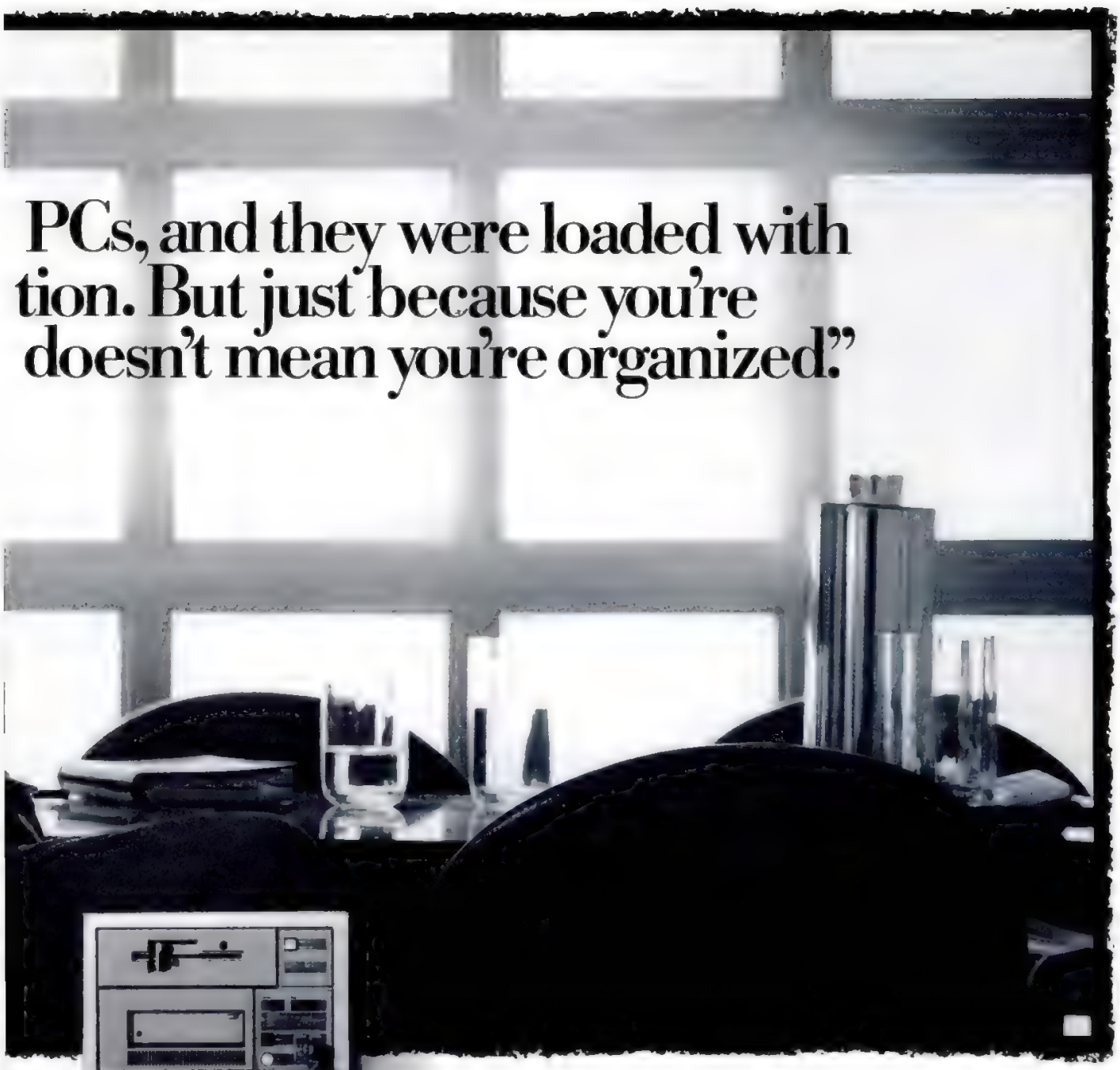
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GRAPHPATH FUNCTION — **COMPLETE LISTING**

```
FUNCTION GraphPath : PathStr;
(*Returns the path to your BGI files.  Assumes
  that at least one of CGA, EGA, or Hercules
  is present.  Asks for user help if it can't
  find them. Requires "USES DOS".*)
VAR
  OneBGI : PathStr;
  Dummy  : NameStr;
BEGIN
  OneBGI := FSearch('CGA.BGI',GetEnv('PATH'));
  IF OneBGI = '' THEN
    OneBGI := FSearch('HERC.BGI',GetEnv('PATH'));
  IF OneBGI = '' THEN
    OneBGI := FSearch('EGAVGA.BGI',GetEnv('PATH'));
  IF OneBGI = '' THEN
    BEGIN
      WriteLn('The BGI drivers are not present on your PATH.');
      WriteLn('Please enter the full path to the BGI drivers,');
      Write('>');
      ReadLn(OneBGI);
    END
  ELSE
    BEGIN
      OneBGI := FExpand(OneBGI);
      FSplit(OneBGI, OneBGI, dummy, dummy);
    END;
  GraphPath := OneBGI;
END;
```

Figure 4: Some of its new features enable Turbo Pascal 5.0 to search anywhere on your PATH to find the .BGI files that are needed. If the search fails, the user is asked for a pathname.

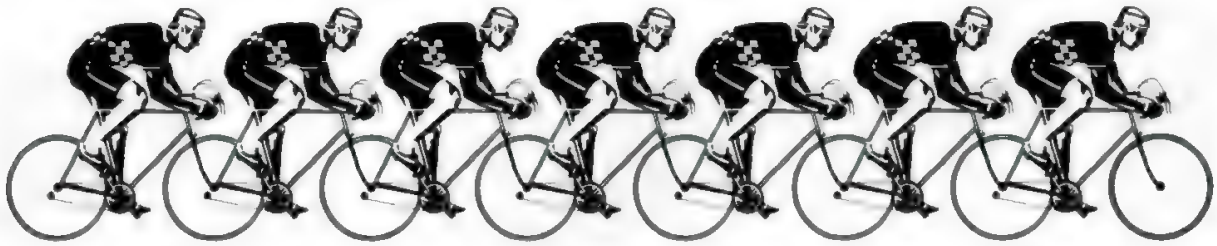
26, the Ctrl-Z character, as indicating end of input. If your graphics image happens to generate a byte value of 26, your printer will stop printing the image. This problem was fixed in Turbo Pascal, Version 5.5.—*Neil J. Rubenking*

PRODUCTIVITY TIP

Here's a quirk. In Turbo Pascal, Version 3, you could enter ".5" or "100." as floating-point numbers. Version 4 changed that, requiring at least one numeric character on each side of the decimal point: for example, "0.5" or "100.0". Version 5 has returned to the relaxed style of Version 3, and ".5" is again a valid numeric entry.

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CIRCLE 334 ON READER SERVICE CARD

edited by
Tony Rizzo

Tutor

RISC AND CISC PROCESSORS

Motorola's annual report mentioned that it is hard at work developing a RISC processor that, by 1991, will be able to run at 100 million instructions per second! What exactly is the difference between RISC and processors such as the Intel 80386, and why are RISC processors so much faster? I thought that they were processors that had specific areas of applicability.

Sean Conway
Cincinnati, Ohio

PC MAGAZINE Perhaps the first thing to do is to explain the basic difference between the two types of architectures. Processors such as the Intel 80386 are known as CISC machines—complex instruction set computers. A CISC processor supports a very large set of hard-wired instructions. Many of these instructions—for example, the multiply instruction—are inherently difficult to hard-wire. They require a large number of transistors to implement and require a large number of clock cycles to execute.

Increasing CISC clock speeds will make CISC machines faster, but the real key to speed is the number of clock cycles a given instruction needs to complete its operation. Because CISC machines have complex, "clock-cycle-hungry" instructions, they tend to be slow.

RISC processors—reduced instruction set computers—are just that, processors that have a smaller, simpler instruction set. You won't find a hard-wired multiply instruction on a RISC machine. Instructions such as multiply are, instead, built up from much simpler instructions. In the case of the multiply instruction, for example, multiple add instructions are executed in place of the multiply.

A major goal of RISC machines is to reduce the amount of time many of the supported instructions take to decode and execute—the ultimate target being one clock cycle per instruction. To accomplish this, RISC processors make heavy use of *pipelining*, where more than one instruction executes in parallel. For example, as one instruction is being fetched, another is being decoded, another is actually executing, and another may be storing data in an on-board register. This is simplifying it just a bit, but it is the basic operation behind RISC. An instruction may actually take four clock cycles to complete, but at the end of the four clock cycles, four instructions will have completed their operation.

It is important to understand that each phase a RISC instruction goes through (fetch, decode, execute, and store) takes one, and only one, clock cycle. CISC processors also make use of pipelining, but most instructions take more than one clock cycle for each phase the instruction goes through.

The relative simplicity of RISC machines also makes it possible to have a much larger number of on-chip registers. More registers mean less dependence on accessing very slow memory, in turn making much higher clock speeds possible. The combination of higher clock speeds and more-efficient instructions makes RISC processors fast machines.

Simplicity has the additional virtue of making it possible to move away from the CMOS technology of the 80386 and into the world of ECL (emitter coupled logic) and gallium arsenide. Already found in supercomputers and larger machines, gallium arsenide and ECL are undoubtedly the building blocks of tomorrow's microprocessors—RISC technology promises to bring tomorrow a step closer.

Some experts, however, seem to feel that RISC technology has already had its day in the sun. Many point to Intel's 80486 CISC processor, which sports many RISC-like features. The number of cycles per instruction, for example, has been reduced to roughly two. On-board caching and pipelining have also been significantly improved. With the enormous number of 386/486 processors (not to mention the 80586, which Intel is hard at work on) expected to reach the market over the next 5 years, many people find it hard to believe that RISC technology will gain much of a foothold, except, as you suggest, in specialized applications.

The more likely scenario, though, is that we will begin to see RISC and CISC processors working together on the same motherboard. The Intel 860 (Intel's own RISC processor) may very well find itself serving as a very-high-speed graphics coprocessor alongside a 486 or 586 serving as a general system CPU. Either way, we can certainly look forward to some very exciting developments just down the road.—*Tony Rizzo*

- **RISC AND CISC PROCESSORS: RISC processors offer several advantages over CISC but will probably remain in CISC's shadow.**
- **PREVENTING STACK OVERFLOWS: DOS tries to protect your system from stack overflows. Sometimes, however, it needs a little help. Learn how to lend a hand.**
- **PARTITION SIZE DECIDES CLUSTER SIZE: Understand how DOS assigns cluster sizes to your hard disk partitions.**

PREVENTING STACK OVERFLOWS

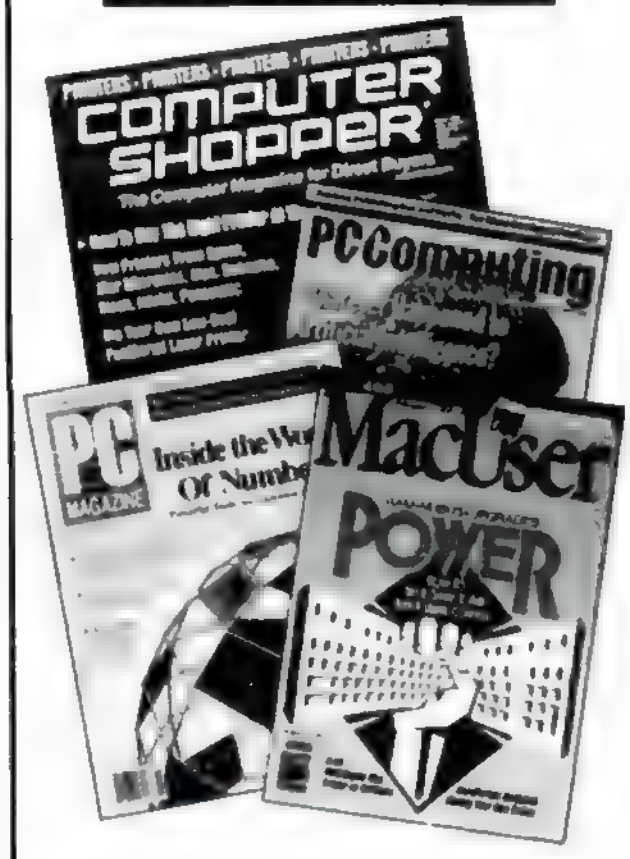
A game program I recently purchased consistently crashed my machine with the message

```
*Internal stack error - system
 halted*
```

I added the line STACKS=12,128 to my

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Tutor

CONFIG.SYS file and managed to get the program to run longer without crashing. I modified the line to read STACKS=24,128, and it ran fine thereafter. What exactly does STACKS do, and what is it about this particular program that crashes my system when a sufficient number of stacks is not available?

John A. Pollack
Malone, New York

PC MAGAZINE Beginning with Version 3.2, DOS attempts to protect the system it is running on from stack overflows that result from nested hardware interrupts. It does this by intercepting interrupts 02h, 08 to 0Eh, 70h, and 72 to 77h and assigning each of them its own stack space. By default, DOS sets aside nine stacks, each 128 bytes in length. Under certain rare circumstances, and given the right kind of hardware, it becomes possible for the number of interrupts arriving at the 8259A interrupt controller within a given time period to be high enough so that they exceed the capacity of the default stack pool. When this happens, DOS halts the system and displays the "*Internal stack error*" message.

STACKS is the method provided by DOS to give you a means of adjusting the size of the stack pool. The first number following STACKS= is the number of stacks to be allocated; the count can range from 8 to 64. The second number is the size of each stack, which can range anywhere from 32 to 512 bytes.

Hardware-related stack problems brought on by software are rare. I'd guess that perhaps your game program disables interrupts at some point and leaves them disabled long enough for a number of interrupts to stack up. Another possibility is that the program increases the frequency of the timer interrupt—something game programs often do—thereby increasing the load on the internal stack handler.— *Jeff Prosise*

PARTITION SIZE DECIDES CLUSTER SIZE

I recently partitioned an 80MB Seagate hard disk into three logical drives containing 32, 32, and 13MB each. I'm puzzled by the cluster sizes. The two 32MB partitions have 2K cluster sizes, while the smaller partition—the one with only 13MB—has a cluster size of 4K. Did something go wrong during formatting? Is there a way to reduce the cluster size from 4K to 2K?

Stephen M. Smith
Waterloo, Ontario
Canada

PC MAGAZINE Nothing went wrong during your formatting; DOS simply went ahead and picked a cluster size for you based on the size of each of your partitions.

When you format a disk under DOS 3.0 or later, DOS chooses between 12- and 16-bit file allocation table entries. This choice depends entirely on the size of the partition being formatted. Partitions less than approximately 16MB in size are formatted using 12-bit FATs and are automatically assigned 4K cluster sizes. Larger partitions are formatted with 16-bit FATs and are assigned 2K cluster sizes, resulting in a maximum capacity of 32MB.

The drawback of using a large cluster size is that it results in inefficient use of disk space if you store a lot of small files on your hard disk. A cluster is the smallest unit of disk space DOS will allocate to a file; a small file, even one only a few bytes in length, will always, at the very least, consume an entire cluster. In the most extreme case, where every file in a partition is less than 2K in length, a partition with 4K clusters would hold only half as many files as a partition of equal capacity with 2K clusters. In practice, however, the presence of large files tends to balance things out.

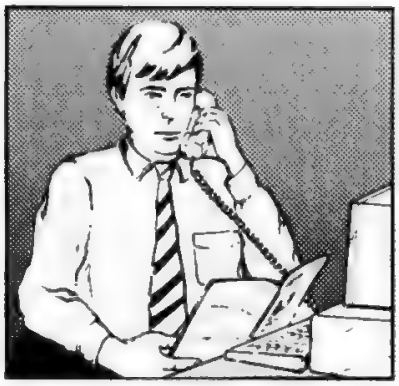
Unfortunately, you can't decide which size is more appropriate—cluster size isn't a user-selectable option. DOS makes the determination of what cluster size to use during formatting and doesn't give you a way to change it—either through the command line switches that accompany the FORMAT command or by any other external mechanism.—*Jeff Prosise*

ASK THE TUTOR

The PC Tutor solves practical problems, explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions personally. ■

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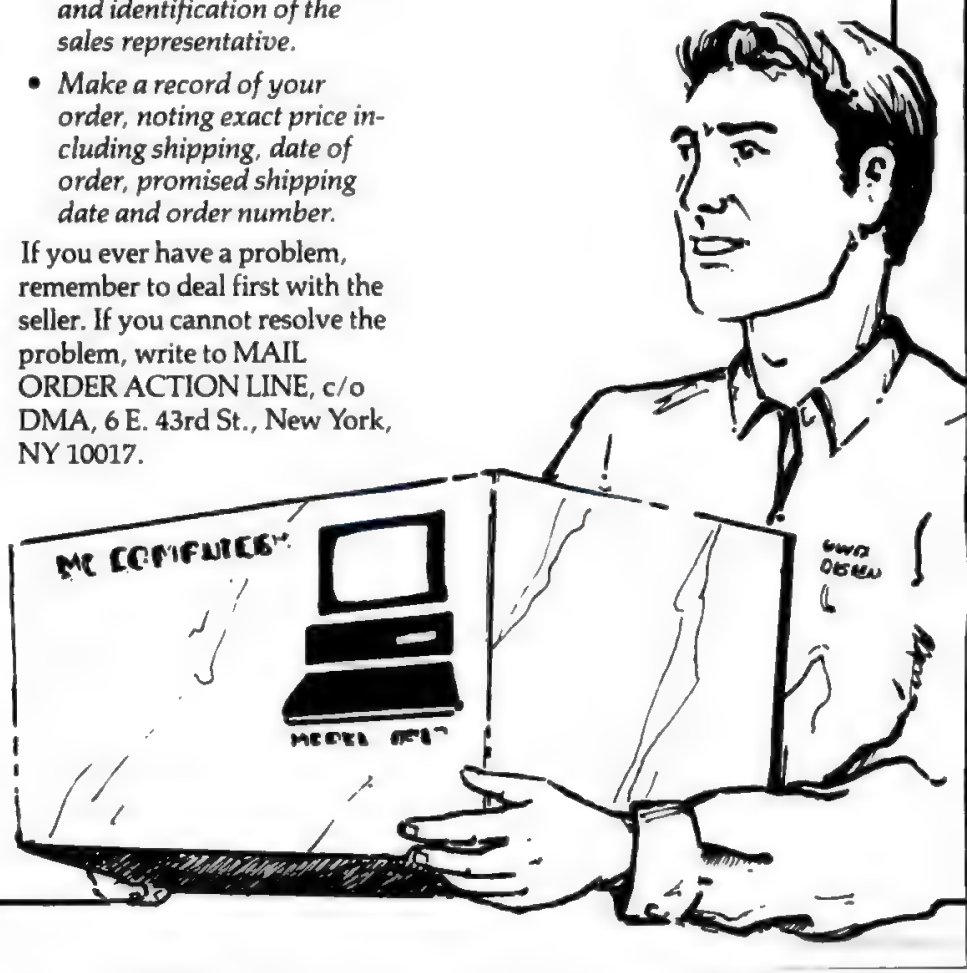
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Leprecards feature components utilizing the latest technology. You can use them as the first or second hard disk in your system. Low power drives mean less strain on your system. You get a 1 year warranty, unlimited technical support, & our illustrated installation and user's guide. Models available for IBM PC/XT and compatibles, AT's and compatibles, as well as the TANDY 1000/A/SC/TX/TL/SL.

FREE SOFTWARE including **TAKE TWO**, the backup utility PC MAGAZINE named "Editors Choice" in 1986 & 1987. Also included are **Menus Direct** and **LEPRECACHE** software from Multisoft.

COMPUTER TYPE	21MB 40MS	32MB 40MS	49MB 40MS	65MB 16MS
8 BIT PC/XT	$299	**$309**	$479	$599
16 BIT PC/AT	N/A	$379	$549	$639

HIGH PERFORMANCE SCSI DRIVES	21MB 40MS	32MB 40MS	49MB [illegible]	60MB 24MS
	$349	$379	**$390**	$689

TakeTwo

MENUS DIRECT

Tandy 1000 models add $20.

DFI HS3000 Scanner

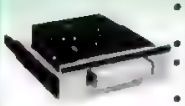
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- 4½" scan width, 400 dpi resolution
- 32 grey scales, .8" per second speed
- Comes with short slot controller
- Use with Hercules, CGA, EGA, & VGA displays
- Includes HALO Desktop Publishing Editor software
- 3000+ Model now available.
- Optional OCR Software available

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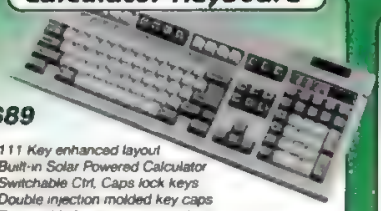
COLORADO MEMORY SYSTEMS, INC.



$279

- 80 Megabytes per tape
- Connects to floppy disk controller
- Uses industry standard QIC-40 format
- 2MB per minute in AT's, 1MB minute in PC/XT's
- External chassis $99 option
- Novell, 3COM & SCO Xenix Compatible
- **DC2000 Cartridges:** $20 ea./6 for $110
- 120MB extra length tapes available

Calculator Keyboard



$89

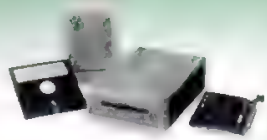
- 111 Key enhanced layout
- Built-in Solar Powered Calculator
- Switchable Ctrl, Caps lock keys
- Double injection molded key caps
- Removable function key template
- ALPS tactile keyswitches as used by Northgate
- 100% PC/XT/AT/386 & Novell network compatible

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3.5" External Floppy Drive. **$279**

The external high density 1.44MB floppy drive for PC/XT computers is the easy way to transfer PS/2 data between systems. It includes a replacement high speed controller, cables and manual.

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720K Internal for PC/XT/AT. **$99**
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1.44MB Internal for AT only. **$109**
- Includes driver software.

1.44MB Internal for PC/XT. **$199**
- Floppy Controller & cables with 500,000 bit/second data transfer rate. Supports 2 drives.

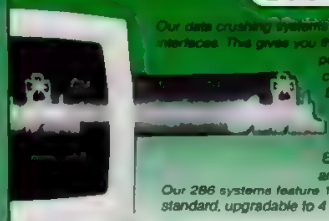
Instant Laptop & PS/2 compatibility. All kits include bracket to mount in 5¼" drive bay, black & grey face plates, and mounting rails. 144MB XT kits include replacement floppy controller that doubles the data transfer rate.

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- **OnTrack** large drive software
- Formatted, Partitioned & Tested

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HH	ST251-1	30ms	MFM	42MB	$369
HH	ST277R	40ms	RLL	65MB	$449
FH	ST4096	28ms	MFM	80MB	$599

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386-20	24.4	4.3	$1,999
386-25	30.5	5.8	$2,799

SCSI DRIVES	PRICE
Seagate ST225N 20 meg 65 ms	$299
Seagate ST157N 49 meg 40 ms	$379
Seagate ST277N 65 meg 40 ms	$469
Seagate ST296N 80 meg 28 ms	$519

VIDEO OPTIONS	PRICE
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VGA Card & 800x600 Multiscan Monitor	$639
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Seagate SCSI Kits

The Small Computer Systems Interface (SCSI) provides increased performance, reliability, and flexibility over ST 412 drives. Performance is improved through improved transfer rates, built in 1:1 interleave and auto error detection and correction.

Shamrock SCSI kits are compatible with all 8088, 286, 386, PS/2 Model 24, 30 and 30/286 systems.

Each kit includes high speed SCSI hard drive with face plate, host adapter, installation guide with menu driven software, and mounting hardware. Bundled software includes the **TakeTwo** backup utility, and **Leprecache** disk cache software. Specify computer when ordering.

Seagate Model	Size	Formatted Capacity	Average Access	Kit Price
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ST138N	3.5"	30MB	40 msec	$369
ST157N	3.5"	49MB	40 msec	$389
ST277N	5.25"	64MB	40 msec	$499
ST296N	5.25"	80MB	28 msec	$559

For Combination SCSI Hard/Floppy Controller add $40



Seagate

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- FREE! **LepreCache** software by Multisoft
- 1-Year Warranty, 30 Day Money Back Guarantee
- Optional 150 Watt, UL/FCC approved power supply for IBM PC's $69



Tandy 1000 kits add $20

30MB KIT $299 (Seagate ST238)
- 32.7MB/65ms/Half-Height/14.8 watts

40MB KIT $439 (Seagate ST251-1)
- 42.7MB/28ms/Half-Height/11 watts

65MB KIT $499 (Seagate ST277R)
- 65.5MB/28ms/Half-Height/11 watts

Seagate Matched Pair Kits 20MB $249 40MB $349
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- 15% faster throughput than ST251 drive

Shamrock

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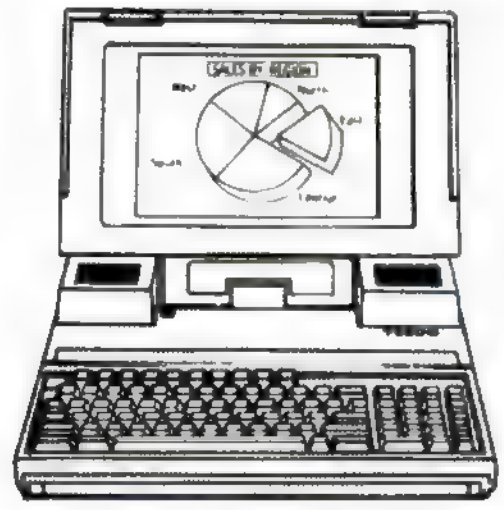
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ProSpeed 286: 40MB	3389
ProSpeed 386: 40MB	4385

SHARP

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PC 4641: 20MB	2265
PC 5541: 386/40MB	3559
PC 7241: 286/40MB	1989

ZENITH

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Supersport 286: 20MB	2939
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Turboesport 386/40	CALL

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With 768K Card	879
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NEC 2400	369
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2400 without Carbon Copy	249
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SHARP FAX 220 629

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FLOPPY 5.25" External for Laptops 360K/1.2MB	299/349
PLUS HARD CARD 20/40 MB	499/629
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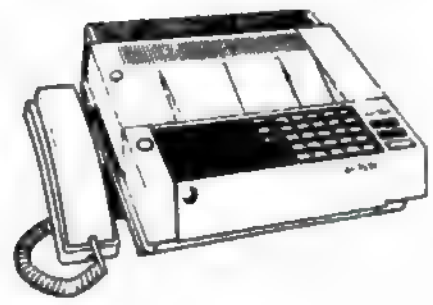
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3167-25 . . . . . $1295
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All coprocessors include our 87Test program.

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PACKARD BELL	ALL MODELS	CALL
EVEREX	286/20MHz 1/2/4MB RAM	CALL
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ALL EVEREX STEP COMPUTERS INCLUDE NATIONWIDE 1-YEAR ON-SITE SERVICE CONTRACT

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SEAGATE	ST238R 30meg kit	269
SEAGATE	ST251-0 40meg 40ms	319
SEAGATE	ST251-1 40meg 28ms	338
SEAGATE	ST4096 80meg 28ms	CALL
TOSHIBA	1.44MB/720K 3.5" FLOPPY	CALL
MOUNTAIN	40meg int/ext	369/CALL
ARCHIVE	40/60/150MB INT/EXT	CALL

MATH CO-PROCESSORS

INTEL	80287-8	197
INTEL	80287-10	224
INTEL	80387-16	355
INTEL	80387-20	386
INTEL	80387-25	495

FAX MACHINES

MURATA-CANON-PANASONIC-SHARP ..... CALL

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PANASONIC			
KXP1180	179	KXP1595	438
KXP1191	229	KXP1524	CALL
KXP1124	319	KXP4450Laser	1369
NEC			
P2200	322	P5300	669
P5200	504	LC890 Laser	3079
OKIDATA			
182 Turbo	225	380	"NEW"
320	329	390/391	463/634
321	463	393/393C	CALL
STAR			
NX1000	169	NX2400	289
NX1000Rainbow	229	XB2415	589
EPSON			
FX-850	CALL	LQ-850	CALL
FX-1050	CALL	LQ-1050	CALL
LQ-510	CALL	LQ-2550	CALL
HEWLETT PACKARD			
DESKJET+	689	LASERJET II	1674
PAINJET	1039	LASERJET IID	2789
DICONIX 150P	299	DICONIX 150+	315

MONITORS

NEC		
MULTISYNC GSW	14" mono	229
MULTISYNC IIA	14" 800x600	489
MULTISYNC 3D	14" 1024x768	649
MULTISYNC plus	15" 960x720	879
MULTISYNC XL	9" 1024x768	2045
PACKARD BELL		
PB1472	14" Flat Monochrome	109
PB1439EG	14" EGA 640x350	348
PB8541VG	14" VGA 640x480	309
MITSUBISHI	14" 1381 DIAMDSCAN	498
MITSUBISHI	16" 6605 1024x768	1289
MITSUBISHI	20" 3905 MULTISCAN	1745
ZENITH	1490 14" VGA 640x480	579
PRINCETON	ALL MODELS	CALL
SAMSUNG	CN4551 MULTISYNC	CALL
SEIKO	CM1430 14" VGA	549
PANASONIC	PANASYNC 1391	"NEW"

VIDEO BOARDS

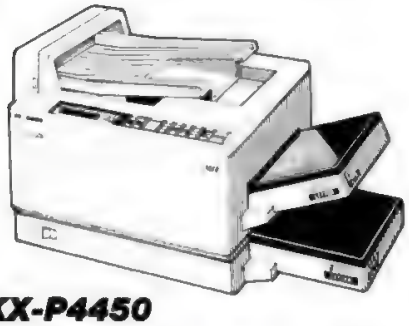
CGA VIDEO BOARD	W/PARALLEL INT	75
ATI	EGA WONDER	219
ATI	VGA WONDER w/mouse 256K	SPECIAL
ATI	VGA WONDER w/mouse 512K	SPECIAL
PARADISE	480 autoswitch	175
PARADISE	VGA+/VGA+16	239/288
PARADISE	PRO	384
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VIDEO 7	Fastwrite VGA	299
VIDEO 7	V-RAM VGA	439
ORCHID	PRO-DESIGNER	CALL
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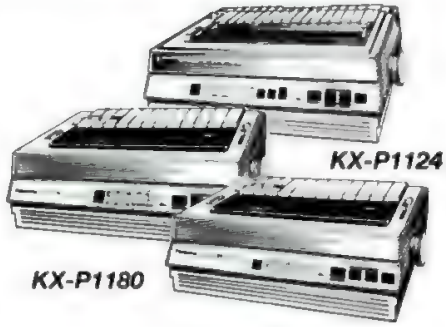
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- 11 pages per minute.
- Two 250 sheet paper cassettes.
- 300 dot-per-inch resolution.
- 5 emulations incl. HP Laser & Epson.
- Parallel and serial interface.
- 512K RAM (1.5 mb upgrade).
- 11 resident fonts.
- Optional legal & envelope cassettes.
- **1 year Panasonic warranty.**

KX-P1180 & KX-P1191

- 9-pin printer.
- 240cps draft (192cps KX-P1180).
- Rear, top or bottom paper feed.
- Push/pull tractor.
- 6K buffer (3K on KX-P1180).
- Auto paper loading feature.
- Paper parking feature.
- Emulates Epson & IBM.
- **2 year Panasonic Warranty.**

KX-P1124

- 24 pin high resolution printer.
- 192cps draft printing speed.
- Rear, front, top or bottom paper feed.
- Push/pull tractor. • 6K buffer.
- Auto paper loading.
- Paper parking.
- 3 macro settings.
- Emulates Epson and IBM.
- **2 year Panasonic warranty.**

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A simple task: don't just make them prettier, make them better. When you consider CompuAdd's reputation, they had no easy task.

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The design team chose to downsize and build five new functions into each new motherboard: a dual IDE hard drive interface, a dual diskette drive controller, two serial ports, a parallel port and a game port interface. These built-in functions reduce by two the number of expansion cards users typically purchase. The result to you: increased functionality and reliability and a smaller footprint.

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What wasn't downsized? Expansion card flexibility and drive configuration options. Every new low profile CompuAdd system is five-card expandable. Up to three full-size and two half-size cards can be added. Users retain maximum flexibility in diskette and hard drive configurations, including the freedom to specify two hard drives.

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1. 30-Day No-Questions-Asked Guarantee.
Every hardware product and every office accessory CompuAdd sells will give complete satisfaction. If not, return it in the original packaging within 30 days of purchase for a full refund of the unit price. Consumable items, opened software, and shipping costs not refundable.

2. Toll-Free Technical Support. Free Return Freight.
If you experience a problem with anything you purchase from CompuAdd, call 800-999-9901 weekdays from 8:00am to 7:00pm, CST. Our technical support staff will be happy to talk you through any hardware or software difficulty. If we cannot resolve a hardware problem over the phone, we will assign you a return material authorization number (RMA). Then, simply ship the equipment freight and insurance prepaid to our Austin Service Center. We will repair or replace the product (at our option) without cost to you and pay for the return freight.

3. No-Charge 90-Day Express Part or Product Exchange.
If a problem affects the service or operation of a component purchased as a CompuAdd system (CPU, monitor, or keyboard) in the first 90 days, we will determine the cause and, if needed, ship a replacement part or product within 48 hours (depending on availability of part), via Federal Express® standard air—at our expense.

4. On-Site Service Available.
On-site service is available within over 260 service areas nationwide on all CompuAdd systems. The CompuAdd 220 and the 300-series systems come with *FREE* on-site service during the initial one-year warranty period. Purchasers of other CompuAdd systems may add a year of on-site service at the time of purchase. Extended two- and three-year warranties are also available on all CompuAdd systems. *A completed service agreement must be received prior to onset of this coverage. Call 800-666-1872.*

Call Today! And discover the new standard for corporate and personal computing.

800-666-1872



Shown with CVGA monitor.

$595
64700

810 Monitor and Hard Drive Options	MGA	CGA	CVGA
No Hard Drive	*64701* $680	*64706* $830	*64711* $1130
20MB (69ms)	*64702* $970	*64707* $1110	*64712* $1410
40MB (69ms)	*64703* $1120	*64708* $1260	*64713* $1560

The CompuAdd 810

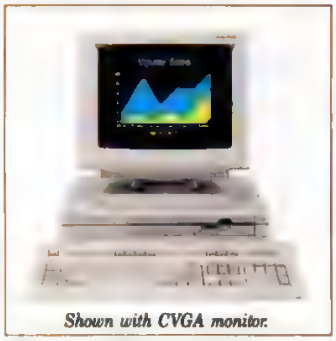
Perfect for word processing, spreadsheet and database applications, the 810 is also an economical alternative for LAN stations that don't need 80286 or 80386 architecture.

An unbeatable value offering:
- NEC V20® processor running at 10MHz
- 640KB RAM with parity checking
- Built-in dual IDE hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size and two half-size expansion slots
- 8087 math coprocessor support
- 5.25" 360KB diskette drive
- Optional real-time clock
- 101-key enhanced keyboard
- 145-watt power supply

The CompuAdd 212

Far and away the best value on the market in a 286 AT machine, the 212 can handle the toughest MS-DOS® based software at 12MHz.

- 80286 processor running at 12MHz
- 512KB RAM expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual IDE hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80287 math coprocessor support
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard
- 145-watt power supply



Shown with CVGA monitor.

$895
64730

212 Monitor and Hard Drive Options	MGA	EGA	CVGA
20MB (28ms)	*64731* $1359	*64736* $1709	*64741* $1799
40MB (28ms)	*64732* $1499	*64737* $1849	*64742* $1939
80MB (15ms)	*64733* $1729	*64738* $2079	*64743* $2169



Shown with CVGA monitor.

$995
64776

The CompuAdd 216

Our new 216 meets the speed and power needs of OS/2® and SCO® XENIX™

- All of the same features as the CompuAdd 212 with a blazing processing speed of 16MHz!

216 Monitor and Hard Drive Options	MGA	EGA	CVGA
40MB (28ms)	*64777* $1599	*64937* $1949	*64782* $2039
80MB (15ms)	*64778* $1829	*64938* $2179	*64783* $2269
110MB (15ms)	*64779* $2029	*64939* $2379	*64784* $2469

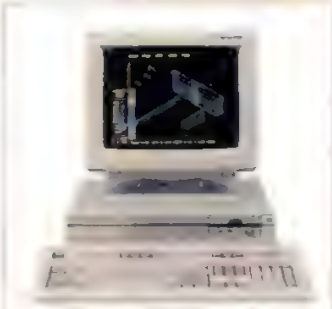
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of CompuAdd computers.

The CompuAdd 316s

Power packed on a small footprint, the 316s opens the door to 386 software at an exceptionally low price. ***Like all 386 machines, the 316s comes with one year of FREE on-site service.***

- 80386SX processor running at 16MHz
- 1MB memory expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual IDE hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80387SX math coprocessor support
- Choice of 5.25" 1.2MB or 3.5"1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard
- 145-watt power supply



Shown with CVGA monitor.

$1495
64787

316s Monitor and Hard Drive Options

	MGA	EGA	CVGA
40MB	*64788*	*64843*	*64793*
(28ms)	**$2099**	**$2449**	**$2579**
80MB	*64789*	*64844*	*64794*
(15ms)	**$2329**	**$2679**	**$2769**
110MB	*64790*	*64845*	*64795*
(15ms)	**$2529**	**$2879**	**$2969**



Shown with CVGA monitor.

$2449
64799

220 Monitor and Hard Drive Options

	MVGA	CVGA
40MB	*64799*	*64805*
(28ms)	**$2449**	**$2899**
80MB	*64800*	*64806*
(15ms)	**$2679**	**$2929**
110MB	*64801*	*64807*
(15ms)	**$2879**	**$3129**
150MB	*64802*	*64808*
(18ms)	**$3329**	**$3579**

The CompuAdd 220

"If what you want is a fire-breathing DOS machine, the CompuAdd (220) is a good choice." *PC Magazine* (April 11, 1989)

- 80286 processor running at 20MHz
- 1MB RAM expandable to 5MB on motherboard
- 0 wait state page-mode memory
- LIM 4.0 support
- ROM shadowing into faster DRAM
- Built-in dual IDE hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Six available expansion slots
- 80287 math coprocessor support
- 40MB IDE hard disk drive
- Monochrome VGA monitor
- 16-bit VGA video adapter card
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 101-key enhanced keyboard
- INTEGRATOR™ software

FREE technical support and on-site service are included in your purchase of a CompuAdd 220 system. ***It's just part of being a completely customer-driven company.***

CompuAdd's Full Profile Systems Can Make You One Of The Big Guys.

From the beginning, CompuAdd has been a new kind of technology company, intent upon building better machines measured against the ultimate standard—better value for the dollar.

Now we offer fully configured 386-systems. The Big Guys. With all the hardware and speed you need to handle the toughest business problems. As *PC Magazine* wrote about them, *"The in-house engineered (320 and 325) are a big step in the right direction"* and *"CompuAdd's (316) is a good example of value you can get for dollars spent by mail."* Call today for prices and capacities.



Shown with CVGA monitor.

CompuAdd's New Career Starter Kit™

At the heart of the new Career Starter Kit is our most affordable IBM®-compatible workhorse, the new CompuAdd 810, with its sleek, small footprint design. Surrounding the 810 is a package that contains everything you need to start computing. Monitor. Printer. Cables. Operating and applications software. Even paper and blank diskettes.

$899
64716

- CompuAdd 810 computer (IBM XT-compatible)
- NEC V20 processor running at 10MHz
- 640KB RAM with parity checking
- Built-in parallel printer port and two serial ports
- Built-in dual IDE hard drive and game port interfaces
- Built-in dual diskette drive controller
- Three full-size and two half-size expansion slots
- 5.25" 360KB diskette drive
- 8087 math coprocessor support
- Monographics monitor and adapter
- Star Micronics NX-1000™ printer and cable
- 101-key enhanced keyboard
- CompuAdd MS-DOS® (v4.01) and GW-BASIC® software
- New Spinnaker® Eight-in-One™ integrated software
- Computer paper and ten blank diskettes

Career Starter Kit Options

	MGA	CGA	CVGA
No Hard	*64716*	*64721*	*64726*
Drive	**$899**	**$1039**	**$1339**
20MB	*64717*	*64722*	*64727*
	$1179	**$1319**	**$1619**
40MB	*64718*	*64723*	*64728*
	$1329	**$1469**	**$1769**

CompuAdd's New Professional Starter Kit™

Looking for the value, savings and convenience of a package purchase? Unwilling to sacrifice quality, flexibility, reliability or technical support when you invest in a business computer? Look no further.

Computerize Your Business for $1495
64747

- CompuAdd 212 computer (IBM AT-compatible) **with 40MB hard drive**
- 80286 processor running at 12MHz
- 512KB RAM expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Built-in dual IDE hard drive and game port interfaces
- Built-in parallel printer port and two serial ports
- Built-in dual diskette drive controller
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80287 math coprocessor support
- Monographics monitor and adapter
- Panasonic® 1180 printer and cable
- 101-key enhanced keyboard
- CompuAdd MS-DOS (v4.01) and GW-BASIC software
- CompuAdd INTEGRATOR™ productivity software
- Real-time clock
- Computer paper and ten blank diskettes

Professional Starter Kit Options

	MGA	EGA	CVGA
40MB	*64747*	*64752*	*64757*
	$1495	**$1845**	**$1935**
80MB	*64748*	*64753*	*64758*
	$1905	**$2255**	**$2345**

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Monographics Video Graphics Array (MVGA) Combo 14" (13" viewable) black and white monitor with CompuAdd VGA card. *51708* **$329**

***NEW!* Desktop Publishing Combo** NEC Monograph™ System monitor, graphics adapter board compatible with PC/XT/AT/386. Up to 1024×1024 resolution. *51707* **$1295**

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CGA color monitor 14" (13" viewable), .52mm dot pitch, 640×200 resolution. *51100* **$239**

EGA color monitor 14" (13" viewable), .31mm dot pitch, up to 640×350 resolution. *51210* **$349**

Mitsubishi Diamond Scan EGA color monitor 14" (13" viewable), .31mm dot pitch, up to 640×350 resolution. *51207* **$535**

NEC® Multisync 2A Super VGA color analog monitor 14" (13" viewable), .31mm dot pitch, up to 800×600 resolution. *51208* **$510**

Graphics Cards

CompuAdd EGA-480 adapter card provides up to 640×480 resolution, 16/64 colors. *48306* **$179**

CompuAdd 16-bit VGA adapter card provides up to 800×600 resolution, 16/256K colors. *48333* **$259**



"One of the giants of mail order, CompuAdd offers quality hard disks, competitive prices, excellent documentation, and courteous service backed up by a 30-day trial period and money-back guarantee."

—PC Magazine, Editor's Choice for Mail-Order Hard Disks, June 27, 1989



Take advantage of the convenience and greater flexibility provided by the speedy ***71MB MiniScribe®*** *(25ms) AT®-compatible MFM hard drive. Every CompuAdd hard drive kit includes the drive, connecting cable, mounting hardware, manual, and FREE PC-FullBak™ disk backup software.* **$569** *47402*

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20MB MiniScribe (65ms). *47001* **$279**
20MB Seagate (65ms). *47002* **$279**
30MB MiniScribe (65ms). *47100* **$299**
30MB Seagate (65ms). *47101* **$299**
40MB MiniScribe (61ms). *47206* **$379**
40MB Seagate (70ms). *47210* **$339**
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ESDI Hard Drives

90MB CDC (18ms, 10MBit). *47405* **$899**
150MB CDC (18ms, 10MBit). *47432* **$1189**
320MB MiniScribe (18ms, 10MBit). *47454* **$1699**
320MB CDC (14.5ms, 10MBit). *47451* **$1789**
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AT Hard Drives

20MB Seagate® (65ms). *47003* **$219**
40MB MiniScribe (61ms). *47203* **$319**
40MB Seagate (28ms). *47207* **$399**
80MB Seagate (28ms). *47401* **$629**

Controllers

Dual diskette/hard drive controller card.

***NEW!* ESDI** 10MBit. *46517* **$180**
***NEW!* ESDI** 15MBit. *46518* **$215**



The new CompuAdd ***HardCache/ESDI Controller*** *reduces system access time to cache data to less than 0.5ms—up to 30 times quicker than even the fastest hard drive! Perfect for any network, CAD/CAM, or graphics application. Features automatic system self-configuration, programmable prereads, and automatic cache set definition. Base configuration 256KB. Upgrades require 100ns SIMMs.* **$495** *46510*



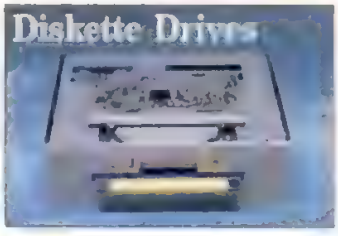
Gain fast access and increased storage capacity with our ***FlashCard-30****. Mounted on a bracket with a controller card for easy installation, this* PC Magazine *Editor's Choice features a 65ms, 30MB MiniScribe hard drive to provide your PC/XT with extra room to store programs and files. Includes a copy of PC-FullBak backup utility software with your purchase.* **$329** *47104*

FlashCard-20™, 20MB MiniScribe (65ms). *47005* **$299**

Multifunction Boards

AT-Multifunction board 0KB expandable to 1.5MB, serial and parallel port. *48701* **$99**

AST SixPakPlus® for PC/XTs 384KB RAM, serial and parallel port, clock/calendar. *48760* **$249**



Our double-sided, high-density 3.5" ***1.44MB diskette drive*** *is an exceptional bargain.* ***(Regularly $109)*** **$89** *45223*

5.25" Diskette Drives

360KB AT drive. *45302* **$99**
1.2MB AT drive. *45350* **$95**

3.5" Diskette Drives

720KB PC/XT drive. *45202* **$89**
720KB AT drive. *45301* **$89**

Memory Cards

AT EMS card 0KB expandable to 2MB. *48102* **$119**

Intel Above™ Board PLUS 512KB expandable to 2MB allows for PC/XT/AT or PS/2-30 multitasking. *48176* **$419**



The CompuAdd Optical Mechanical Mouse *features 200 dpi resolution, Dr. Halo III™ paint software, mouse pocket, and pad.* ***(Regularly $55)*** **$44.99** *55052*

Logitech® Serial Mouse 320 dpi resolution, MouseWare™ utilities, and Pop-Up™ DOS software. *55059* **$79**

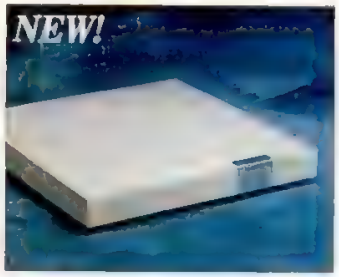
Logitech Serial Mouse (ATs / PS/2s) resolutions from 50-1500 dpi, MouseWare utilities, and Pop-Up DOS software. *55058* **$89**

DFI Handy Scanner® 3000 Plus 100-400 dpi, 4.125" scan window, 32-level gray scale, and ZSoft PC Paintbrush® Plus. *56011* **$199**

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Master Piece power centers *protect your personal computer and peripherals from surges, spikes and noise. Five outlets connected to one master switch. Features EMI-RFI filtration to protect data.* **$89.95** *40651*

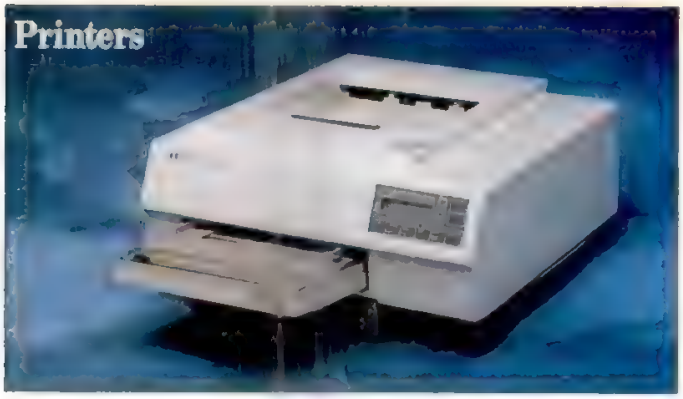
American Power Conversion *uninterruptible power supplies provide five to 65 minutes of operating time for safe exiting of sofware applications. Features noise filter and surge suppression, maintenance-free battery and charger, overload protection, and two-minute warning before final shut down. 200 [300, 360] watts.* ***Model 450AT for AT, PS/2-80 and 386 systems.*** **$425** *40710*

Master Piece Plus power center includes modem protection and warning indicator for chronic low voltage. *40656* **$109**

Model 520ES for file servers. *40711* **$499**

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Internal J. T. FAX board (4800 bps). *56107* **$549**



Enhance the quality of your documents with a ***Hewlett-Packard LaserJet Series II.*** *Features 512KB RAM, toner cartridge, a 200-sheet letter-size input tray, and RS-232/ parallel interface.* **$1749** *56800*

Panasonic® 1180 (11" carriage, 192 draft/38 NLQ). *56380* **$195**

Epson® LX-810 (11" carriage, 180 draft/30 NLQ). *56303* **$199**

Okidata Microline® 320 (11" carriage, 300 draft/30 NLQ). *56359* **$339**

Epson FX-1050 (11" carriage, 290 SuperDraft/54 NLQ). *56313* **$469**

Panasonic 1124 (11" carriage, 225 draft/60 LQ). *56369* **$339**

Epson LQ-510 (11" carriage, 225 draft/60 LQ). *56340* **$349**

Hewlett-Packard DeskJet laser quality printer (240 draft/120 LQ). *56451* **$575**

Star Micronics NX-1000™ Rainbow color printer (11" carriage, 144 draft/36 NLQ). *56443* **$225**

Epson LQ-2550 color printer (15" carriage, 400 draft/133 cps). Color ribbon optional. *56339* **$999**

Hewlett-Packard PaintJet color graphics printer. *56450* **$995**

QMS-PS® 810 Adobe® PostScript® laser printer. *56821* **$3949**

QMS Big Bin sheet feeder with 1000 sheet capacity. *38505* **$635**

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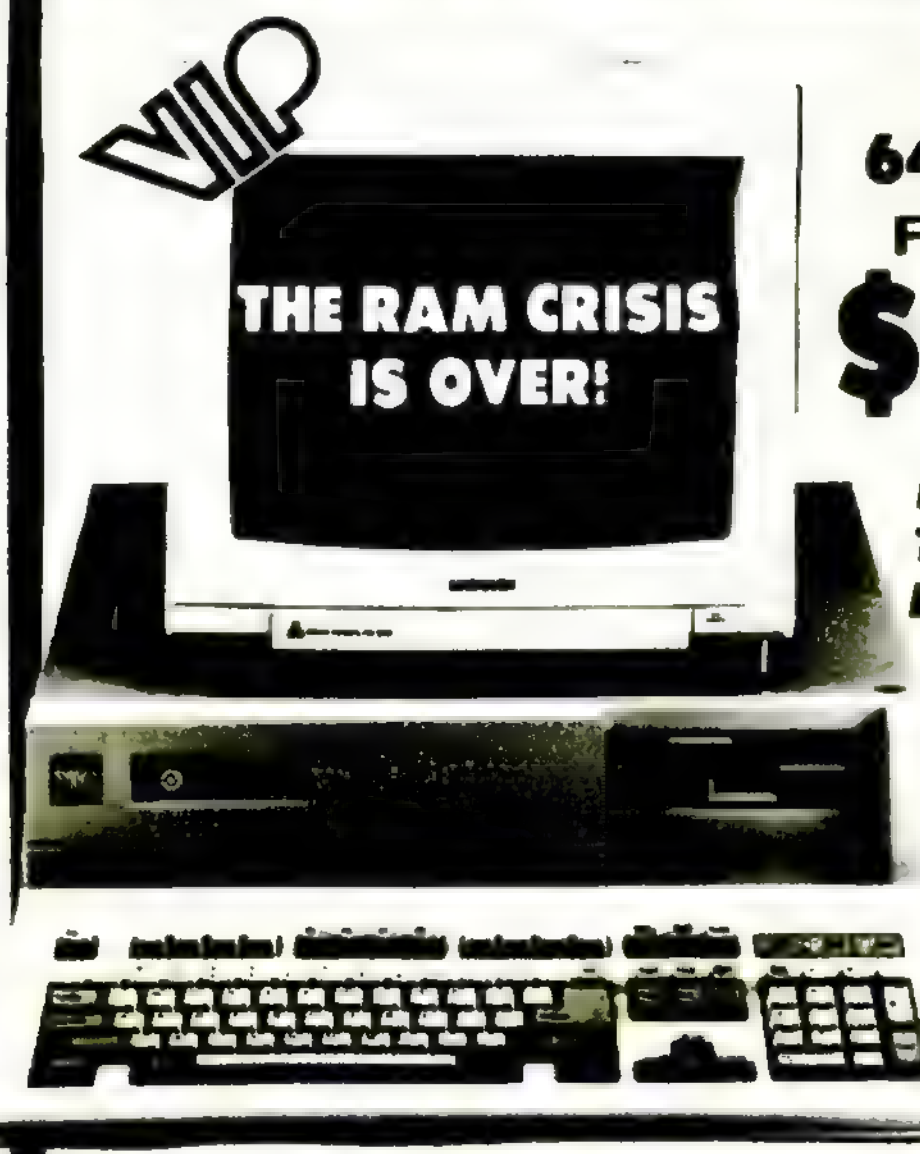
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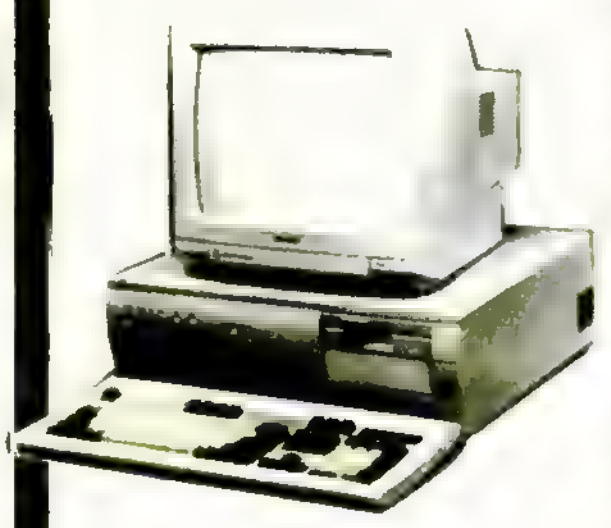
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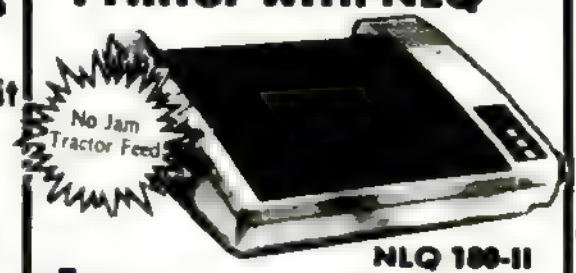
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40MB XT Kit #8450	299
40MB AT #3650	259
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Seagate	
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40MB AT #251-1	319
65MB AT #277R-1	365
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Q & A	197
RapidFile	179
Rbase for DOS	439
Reflex	159

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Byline	175
GEM Desktop Pub.	159
Pagemaker	479
PFS:First Publisher	69
Publisher's Paintbrush	149
Ventura	Call

Financial

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Peachtree Complete II	139

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Deluxe Paint II	67
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Mice

Keytronics Professional	75
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Programming

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Norton Guides (Specify)	58
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Turbo Basic	60
Turbo C 2.0	90
Turbo Pascal 5.0	90
Quick Basic	60
Quick C	60
Quick Pascal	60

Spreadsheets

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Lotus	Call
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Quattro	145

Utilities

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Carbon Copy Plus	104
Desklink	95
Desqview	68
Desqview386	99
Direct Access	46
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Formtool	54
Formfiller	85
Laplink Plus	59
Laplink III	75
MS-Dos 4.01	79
Mace Utilities	53
Norton Advanced	79
PC Tools Deluxe	Call
ProComm Plus	42
SideKick Plus	119
Sideways	37
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Word Processors

Ami	Call
GEM First Word Plus	57
Grammatik III	49
Manuscript	Call
Multimate Adv. II	267
Professional Write	125
Rightwriter	45
Sprint	117
Q & A Write	109
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Word Perfect	215
Word Perfect Library	59
WordStar Prof. 5.5	189

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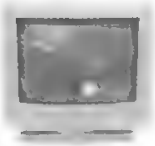
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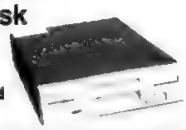
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ST157N

ST225XT

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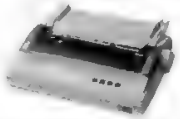
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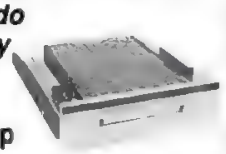
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CPU	8088-2	8088-1	V20	80286	80286	80386	80386
Speed (Mhz)	8.4 77	10.4 77	12/4 77	12 5/8	16/8	20/8	24/8
BIOS	ERSO	ERSO	ERSO	AMI	AMI	AMI	AMI
Wait States	1	0/1	0/1	0/1	0/1	0/1	1
Standard Memory Config.	640K	640K	640K	1MB	1MB	1MB	1MB
On Board Memory Expansion				4MB	8MB	8MB	8MB
Shadow RAM BIOS					384K	384K	384K
Coprocessor Support	8087	8087	8087	80287	80287	80387	80387
Expanion Slots	8-8 bit	8-8 bit	8-8 bit	2-8,6-16	2-8,6-16	2-8,5-16	2-8,5-16
Dual Hard Floppy Controller	w/H.D.	w H D	w/H D	Yes	Yes	Yes	Yes
Device Bays(E-external,I-Int.)	4-E	2-E,2-I	2-E,2-I	3-E,2-I	3-E,2-I	3-E,2-I	3-E,2-I
Serial Ports	1	1	1	optional	optional	optional	optional
Parallel Ports	2	2	2	1	1	1	1
Game Ports	2	2	2	1	1	1	1
Bus Mouse Port	1	1	1	1	1	1	1
Power Supply Size	150W	150W	150W	200W	200W	200W	200W
Key Tronics USA Keyboard	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EZ-DOS 4.0 w/GEM,TopDOS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Battery Backup Clock	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Norton SI Rating 4.0Version	1 8	2 1	4 9	14	18.3	22 5	26
Landmark Speed	3 1	4 1	5	16 5	21	24	28

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640K	2 / (2) 360K Floppy Drives	$549	$636	$787	$1 001	$769	$1 066	$1 214
8 MHZ	20 / 22MB,60MILS,MFM 3.5"	$729	$816	$967	$1 181	$949	$1 246	$1 394
	30 / 33MB 60MILS, RLL, 3.5"	$759	$846	$997	$1 211	$979	$1,276	$1 424
88-12	1 / (1) 360K Floppy Drive	$554	$641	$792	$1 006	$774	$1 071	$1,219
640K	2 / (2) 360K Floppy Drives	$624	$711	$862	$1 076	$844	$1 141	$1 289
12 MHZ	20 / 22MB 60MILS MFM 3 5"	$804	$891	$1 042	$1 256	$1 024	$1 321	$1 469
	30 / 33MB 60MILS, RLL, 3.5"	$834	$921	$1 072	$1 286	$1,054	$1 351	$1 499
286-12	1 / (1) 1 2MB Floppy Drive	$799	$886	$1 037	$1 263	$1,079	$1 356	$1 449
1024K	20 / 60MILS,MFM,2-1 KL320	$999	$1,086	$1 237	$1,463	$1,279	$1 556	$1 649
12.5 MHZ	20 / 38MILS MFM,2-1,ST125	$1 079	$1 166	$1,317	$1 543	$1 359	$1 636	$1 729
0-WAIT	30 / 38MILS,MFM,2 1,ST138	$1 139	$1 226	$1,377	$1 603	$1,419	$1 696	$1 789
Exp to 4MB	40 / 26MILS,IDE,1 1 MS8051	$1 189	$1 276	$1 427	$1,653	$1,469	$1 746	$1,839
AMI BIOS	65 / 38MILS RLL 1 1 MS3650	$1 219	$1 306	$1 457	$1 683	$1 499	$1 776	$1 869
Norton SI 14	85 / 28MILS,SCSI,1-1,ST296N	$1 319	$1 406	$1,557	$1 783	$1 599	$1 876	$1 969
Speed 16 1Mhz	120 / 28MILS RLL,1 1 CDC94155	$1 609	$1 696	$1 847	$2,073	$1 889	$2,166	$2 259
286-16	1 / (1) 1.2MB Floppy Drive	$879	$1 066	$1,217	$1 443	$1,259	$1 536	$1 629
1024K	20 / 60MILS,MFM 2-1,KL320	$1 189	$1 276	$1 427	$1,653	$1 469	$1 746	$1 839
16 MHZ	20 38MILS MFM 2 1 ST125	$1,259	$1 346	$1,497	$1 723	$1 539	$1 816	$1 909
0-WAIT	30 38MILS MFM 2 1 ST138	$1 319	$1 406	$1 557	$1 783	$1 599	$1 876	$1 969
Exp to 4MB	40 / 26MILS,IDE,1-1,MS8051	$1 349	$1 436	$1 587	$1 813	$1 629	$1 906	$1 999
AWARD BIOS	65 38MILS RLL 1 1 MS3650	$1 399	$1 486	$1,637	$1 863	$1 679	$1 956	$2 049
Norton SI 18	85 28MILS SCSI 1 1 ST296N	$1 509	$1 596	$1 747	$1,973	$1 789	$2 066	$2 159
Speed 21 8Mhz	120 28MILS RLL 1 1 CDC94155	$1 789	$1 876	$2 027	$2,253	$2 069	$2 346	$2 439
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1024K	20 60MILS MFM 2 1 KL320	$1 339	$1 426	$1 577	$1 803	$1 619	$1 896	$1 989
20 MHZ	20 38MILS MFM 2 1 ST125	$1 409	$1 496	$1 647	$1 873	$1 689	$1 966	$2 059
0-WAIT	30 / 38MILS,MFM,2 1,ST138	$1 469	$1 556	$1 707	$1 933	$1 749	$2 026	$2 119
Norton SI 21 9	40 26MILS IDE 1 1 MS8051	$1 499	$1 586	$1 737	$1 963	$1 779	$2 056	$2 149
Speed 25 Mhz	65 38MILS RLL 1 1 MS3650	$1 549	$1 636	$1 787	$2 013	$1 829	$2 106	$2 199
Exp to 8MB	85 / 28MILS SCSI,1-1,ST296N	$1 659	$1 746	$1 897	$2 123	$1 939	$2 216	$2 309
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Exp to 8MB	160 / 16MILS,ESDI,1-1,MS3180	$2 969	$3 056	$3 207	$3 433	$3 249	$3 526	$3 619
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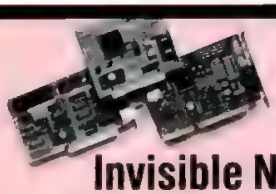
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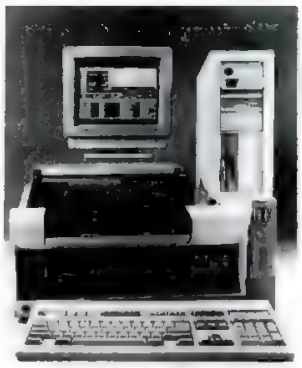
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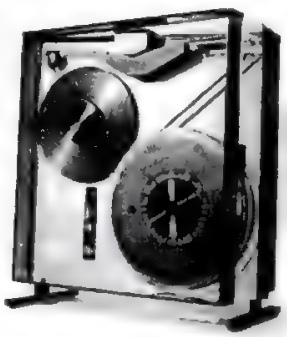
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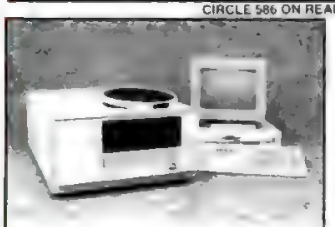
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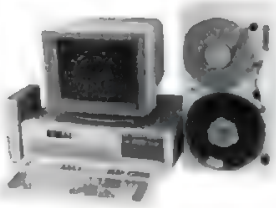
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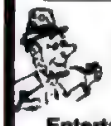
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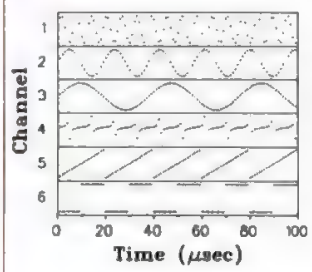
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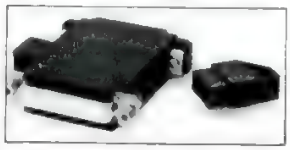
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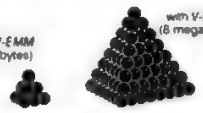
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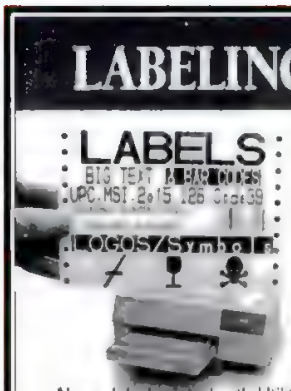
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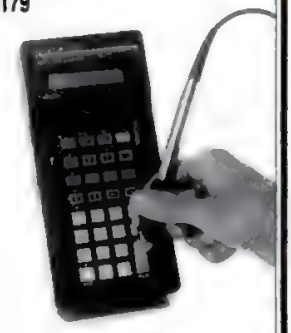
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COMING UP

■ THE SIXTH ANNUAL PRINTER ISSUE

PC Magazine's most popular issue returns this year with more than 100 printers. Camping out in PC Labs, reviewers ran this year's printers through our most grueling set of benchmark tests yet.

■ LASERS

Glamour comes in all sizes and speeds this year. Among laser printers, you'll find many exciting—as well as some perplexing—combinations of features, performance, and price. This year more printers are offering both PostScript and HPPCL as command-set options. Resolutions are increasing as more machines cross the 400-dot-per-inch threshold, and *PC Magazine* evaluates high-end color page printers for the first time ever.

■ DOT MATRIX

While the cost of impact printers has not dropped much since our 1988 printer issue, this year's printers proffer higher-quality output, greater speeds, and more features for the same price. High-end dot matrix printers are yielding more-sophisticated paper handling and more resident near-letter-quality fonts. The enhancements have filtered down even to the market's low end, where features such as paper park and forms tear-off are becoming standard. This year's array of printers will also tempt you with color capabilities. Look for a selection of portable printers as well.

■ NEW TWISTS TO OLD TESTS

Keeping pace with improvements in the printers themselves, our PC Labs benchmark tests now include more-exacting graphics tests, and color output tests. You can feast on all of the results in *PC Magazine*'s Printer Guide, and if you need to find information on printers from previous years, our index of previously reviewed printers will prove invaluable. ■

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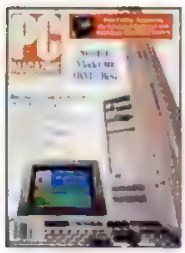
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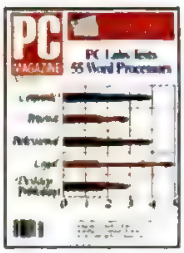
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After Hours

Products for the Leisure Side of Personal Computing

Two Simulations Bring Tom Clancy's Submarine Warfare Epics to the PC

GAMES
by Robin Raskin

Tom Clancy, the insurance agent turned novelist, has carved a niche for underwater intrigue on the nation's bestseller list. New software packages from The Software Toolworks and MicroProse take different tacks in translating two of Clancy's novels to the PC.

The Software Toolworks' *The Hunt for the Red October* stays close to the novel's plot. You navigate a Russian nuclear submarine to Cuba, where you plan to defect to the West. The software mimics the hard-copy voyage, but the action is slow.



Red Storm Rising, from MicroProse, offers a dizzying array of technology for hardcore PC submariners.

HARD-HITTING ACTION

Those who thirst for a bit more of a jolt will go for MicroProse's *Red Storm Rising*. The game offers a weaker tie to Clancy's plot, a World War III scenario fought with conventional weapons. But what *Red Storm* lacks in fidelity to the novel, it makes up in exciting, hard-hitting action sequences.

Red Storm is, however, more faithful to Clancy's technology than Software Toolworks' offering. Weaponry, navigational controls, and tactical reports are staggeringly complex and realistic. And while the game depends more on strategy than shoot-'em-up reflexes, your arcade chops make a difference because you must often react very quickly.

Red Storm's action takes place in the northern waters between the Soviet Union's ports and NATO's European home waters. Using control panels, instrumentation, and tactical data, you carefully navigate the waters, monitor your surroundings, and plan maneuvers.

Unfortunately, you'll spend a great deal of time memorizing the keyboard combinations used to play the game. Unwilling to make this my primary software application, I played haltingly, constantly referring to the manual and depending too much on an ungainly keyboard template that kept sliding onto my keys.

Meanwhile, the neighborhood youths quickly committed the keystrokes to memory and played with considerable fluidity. The game supports a joystick but, unfortunately, not a mouse.

Red Storm Rising perpetually tests your gaming skills. Navigational controls adjust speed, depth, and direction. There are enough weapons to make a soldier of fortune jump for joy. Sonar, radar, periscopes, and acoustic signatures are just some of the game's options. Color-coded strategic maps detail the waters in which you sail. The display area offers iconic representations of you and your encounters.

The game builds to a crescendo. Training scenarios hone your tactical prowess and ready you for full-fledged battle. Battles offer immediate gratification and play out quickly.

Red Storm's acme, however, is its full-blown campaign simulation. You experience the entire progress of a conventionally fought World War III. The submarine technology adjusts to your choice of a time period (1984 to 1996). You can also choose a level of play, with "Ultimate" offering a less than optimistic chance for survival.

MicroProse is dead serious about software piracy. A key disk must be inserted before play. In addition, you're asked to refer to the manual and identify a submarine or warship that appears on your screen during the initial moments of play. No manual, no play.

While *Red Storm Rising* provides compelling, option-filled play for those willing to expend the effort, *The Hunt for the Red October* is the game for "everyman." Even if you're submarine illiterate, you can manage to play through this one.

JUST LIKE THE BOOK

The Hunt's premise hews closely to the plot of the novel. You must travel, undetected and unsuspected, through miles and miles of dangerous waters. Of course, you've said nothing to your crew about your treasonous intentions. A paperback copy of the novel is bundled with the software, providing a nice literary tie-in.

The action takes place on a main display window, where a

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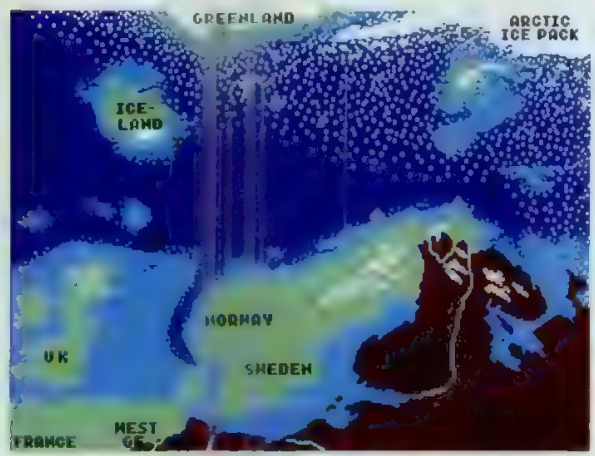
CIRCLE 497 ON READER SERVICE CARD

Submarine Simulators

CONTINUED

series of maps, periscope views, and sonar and hydrophonic charts are at your disposal.

The Hunt for the Red October is certainly a prettier game to play than *Red Storm Rising*. The maps and display screens are colorful and filled with visuals. Instead of using keystrokes to change display options, you select from tools displayed vertically on the side of the screen.



The Software Toolworks' *The Hunt for the Red October* is less weaponry-intensive than *Red Storm* but has prettier graphics.

The weaponry and navigational tools are more directly manipulatable than *Red Storm*'s. Response to commands is also faster and more fluid. The periscope offers a more realistic view than you get in *Red Storm*.

Other tiny details playfully boost the game's Soviet authenticity. The cursor, for example, is a sickle with an arrow in it. Better yet, all of the letter *R*s in the menu selections are written backwards to give you that Cyrillic feel.

Unlike *Red Storm*'s gigantic arsenal, *Red October*'s has only generic torpedoes. You target and launch the torpedoes from a Weapons submenu and watch the action on a display screen.

Pretty bells and whistles aside, *Red October* suffers from slow action. The initial stages of defection are downright boring, and I played for 20 minutes before I saw even one lonely trawler. Most of my initial plays ended sinkingly as I collided with ice floes or ran into shallow water.

You can speed up the action with a special time-lapse command. But while this gets some mileage under your belt, you often ram into obstacles and are sent plummeting to the ocean floor.

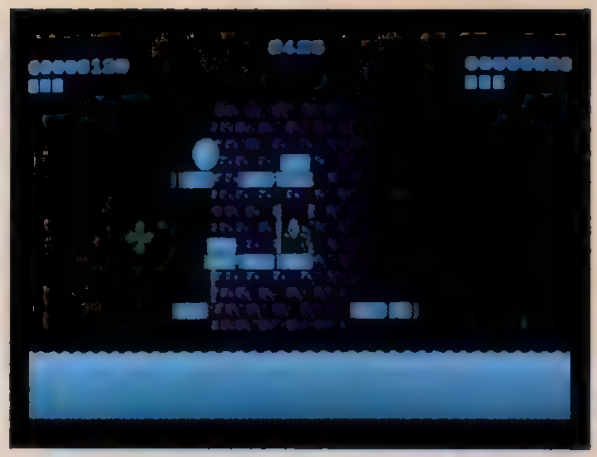
There are three levels of play, but that doesn't compare with the wealth of *Red Storm*'s options. On the other hand, the game has considerably less overhead than *Red Storm*. *Red October* is served up on a single, non-copy-protected disk with a brief but engaging manual.

Both games take advantage of the computer's sound capabilities, intermingle attractive full-screen animation with control-panel instrumentation, and offer detailed strategies in their manuals. Clancy's devotees will get a charge out of both games, but submarine buffs will appreciate the "depth charge" they get from *Red Storm Rising*.

List Price: *Red Storm Rising*, $54.95. **Requires:** 384K RAM; CGA, EGA, VGA, or MCGA graphics; DOS 2.1 or later. Copy protected. MicroProse, 180 Lakefront Dr., Hunt Valley, MD 21030; (301) 771-1151.

List Price: *The Hunt for the Red October*, $49.95. **Requires:** 512K RAM, EGA or CGA graphics, DOS 2.1 or later. The Software Toolworks, 19809 Nordhoff Pl., Chatsworth, CA 91311; (818) 885-9000.

CIRCLE 602 ON READER SERVICE CARD



In *Tower Toppler*, you must make your way along the treacherous route to the top of a series of towers.

Tower Toppler: Scale the Heights To Save A Planet

GAMES
by Don Trivette

A distant planet, a toxic ocean, a minisub, and eight rotating towers are all part of *Tower Toppler*, a new game from U.S. Gold. But the tower, ocean, and sub are just dressing on an old-fashioned arcade game much like Frogger of years ago.

The object of *Tower Toppler* is to climb to the top of each tower and set off a destructive device that causes the tower to fall. Then it's on to the next tower—via minisub, of course—to continue toppling. Only by blowing up all eight towers can you save something or other; it isn't clear what happens on the planet Nebulus if you fail, but you can bet it won't be pretty.

Each tower has a name that describes its most conspicuous obstacle. The Tower of Eyes, the first tower, is protected by large flying eyeballs (and this was before *Hardtime on Planet Earth*) capable of knocking you into the toxic drink. Three swims in the sea and you're out. Start over.

The second tower features robots that sabotage your progress; I can't tell you what the major perils are for the towers beyond the third, Trap of Tricks, because I'm still trapped by the tricks. If the good folks of Nebulus are depending on me for their deliverance, they are out of luck.

Forget the contrived story about a planet and a sick sea (we've got the real thing in Alaska); *Tower Toppler*'s real panache is in its graphics. The towers rotate in a manner that gives you the feeling of playing a three-dimensional game.

If you succeed in toppling all eight towers, the F6 key will bring up a new mission with eight new towers.

There are a few variations to add interest to *Tower Toppler*'s cylindrical obstacle courses. You carry a snowball gun that destroys flashing barricades, but it's useless against mutant molecules, robots, and the stray cannonballs that come your way. Nor is a weapon any help with slippery ledges, dark tunnels, and crumbling walkways. There is a clock—there's always a clock—against which you race; and the extra points collected by blasting fish as you minisub from tower to tower add up to extra lives. You'll need 'em.

List Price: *Tower Toppler*, $49.95. **Requires:** 256K RAM for CGA, 512K RAM for EGA/VGA graphics; CGA or EGA adapter; DOS 2.1 or later. Copy

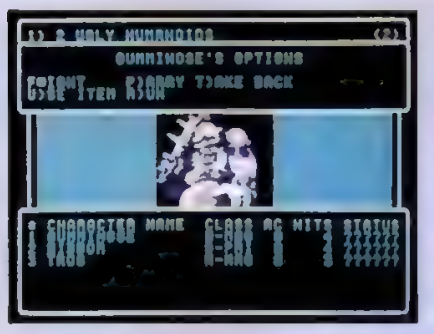
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CIRCLE 613 ON READER SERVICE CARD



Wizardry V: Heart of the Maelstrom is long on role-playing action but short on graphics.

Wizardry V: New Vistas for PC Adventurers

GAMES
by Barry Brenesal

Wizardry V: Heart of the Maelstrom, from Sir-Tech Software, is a role-playing fantasy cast in the mold of its now-classic predecessors. Somewhere deep in the dungeon beneath Llylgamyn reigns the evil, powerful Sorn, who is holding the immortal Gatekeeper prisoner. He must be freed, or the land (and, by implication, you) will be laid waste.

You begin play by randomly generating a series of six fighters, sorcerers, and thieves. Next, seek battle in the dungeon, where success is crowned with money and useful experience points.

The combat system, though less sophisticated than that of *Ultima* or *The Pool of Radiance*, employs four ranged classes of weaponry. Since you share a point of view with one of your characters, results are displayed rather than the combat itself. Command options are quite simple. The graphics are nothing special by any standard: simple line drawings make up the dungeon maze, where mapping is a way of life—and the only means of sustaining it.

Wizardry V excels in offering a series of intriguing subplots while unfolding the larger quest. Frequently this is accomplished with a dash of zany humor. Among the cast of dungeon inhabitants are a drunken wizard to kill or con and a prince who was turned into a monster and is cursed with athlete's foot. Brenda Garno's accompanying documentation is extremely literate and highly amusing.

Unfortunately, *Wizardry V: Heart of the Maelstrom* cannot be installed on a hard disk. Although the program will run on either one or two floppy disks, two are a virtual necessity for decent speed. Software protection is enforced by a hooded figure who appears in every gaming session, demanding the third word of a magic spell. There are 1,296 possible replies given on a dark brown pamphlet. Like some other games, *Wizardry* doesn't run under DOS; the game disks include a proprietary operating system.

Wizardry V includes loads of spells to cast, weapons and armor to find, and villains to fight. Along the way, you will also encounter specially cursed or blessed magic items to try. The executive-by-day is herewith encouraged to don cuirass or talisman by night and venture forth into Sir-Tech's latest fantasy.

List Price: *Wizardry V: Heart of the Maelstrom*, $49.95.

Requires: 256K RAM; CGA, EGA, or VGA card; color, RGB or composite monitor. Sir-Tech Software Inc., P.O. Box 245, Ogdensburg, NY 13669; (315) 393-6633.

CIRCLE 603 ON READER SERVICE CARD

Backgammon Comes to Windows, at High Resolution

GAMES
by Barry Simon

As its name suggests, E. F. Dickey & Co.'s *Windows Backgammon Deluxe* runs under *Microsoft Windows*. The *Windows* environment has quite a lot to offer game designers, and *Windows Backgammon Deluxe* exploits some of the graphical operating environment's unique capabilities. For one thing, *Windows Backgammon* is one of the few games available that supports IBM's 8514A monitor. (*Windows/286* has supported this monitor since June 1988, and 8514 support has recently been added to *Windows/386*.)

The graphical interface is a natural for backgammon, since the game mainly involves moving tokens. Just as you move your hand, grasp the token, and move your hand some more in a real game, in *Windows Backgammon* you move the mouse, press the left button to pick a token up, and drag it to a new location. When there is only one move possible from a group of selected tokens, the right button is used as a shortcut to make that move.

You can play *Windows Backgammon* either as a two-person game or against the computer. Because computers don't come with two mice, the two-person game is somewhat awkward. The only way that I found to play it easily was to have one person make all of the moves.

The skill level of the software was neither expert nor novice. I'm certainly not a backgammon duffer, having played on and off for 30 years, but I'm not a shark either. At its higher skill level, I could beat *Windows Backgammon Deluxe* about three times out of four. An expert would probably trounce it. A beginner could shift to the lower skill level and have a lot of fun.

The game includes a doubling cube and uses an intelligent algorithm to decide whether to redouble, quit, or just continue. Since you can double, it is unfortunate that you cannot keep track of the score within the game.

Windows Backgammon is a great way to take a break from your *Excel* projections, *Designer* drawing, and *PageMaker* newsletters. And soon there will be a Presentation Manager version, which will allow you to recoup at least something from your investment in OS/2.



Windows Backgammon Deluxe even includes a doubling cube. Will you accept the dare?

List Price: *Windows Backgammon Deluxe*, $29.95.

Requires: *Microsoft Windows* 2.0 or later. E. F. Dickey & Co., 306 E. Maple St., Fairbury, IL 61739; (815) 692-2533.

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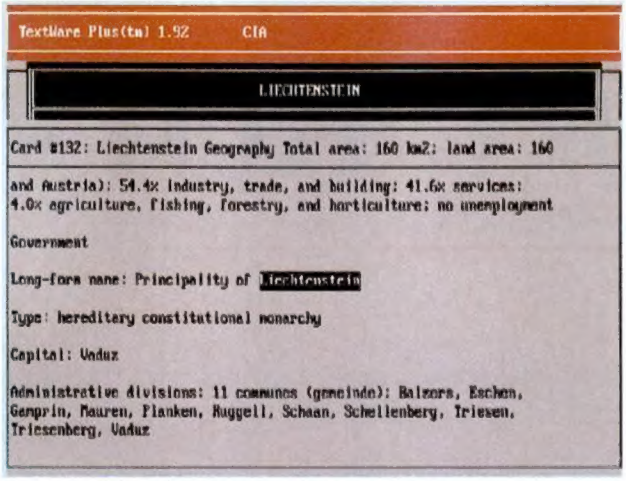
After Hours

The CIA World Factbook Takes You Around the World on a ROM

EDUCATION
by Don Trivette

Have you ever wondered what you call someone from Liechtenstein? Liechtensteinite? Liechtensteino? According to *The CIA World Factbook* (1988), residents of that country are called Liechtensteiners. And an uncommonly content people they would seem to be: their emigration rate is zero (versus a U.S. rate of 2.46 per 1,000), their inflation rate is 1.5 percent, and their life expectancies exceed ours.

Those are just a few of the fascinating facts I found in the federal government's own world almanac, which is now available in a CD-ROM version from Quanta Press.



***The CIA World Factbook* offers everything you will probably ever want to know about Liechtenstein.**

The database, covering 248 countries and geographic areas, is organized on "cards" (presumably it was actually kept on cards in simpler times). All 23,000 words in the almanac are indexed, so entering "United," for example, yields 45 cards, only one of which is for the United States.

Highlight the card you want, press enter, and the software reports the collective knowledge of the Central Intelligence Agency (minus classified material, of course), the Bureau of the Census, the Defense Intelligence Agency, the Defense Nuclear Agency, the Departments of State and Interior, and the Coast Guard.

All of the cards have the same format and categories, which include area, maritime claims, climate, terrain, resources, ethnic divisions, religion, government, diplomatic representatives (names, addresses, phone numbers), imports/exports, and currency.

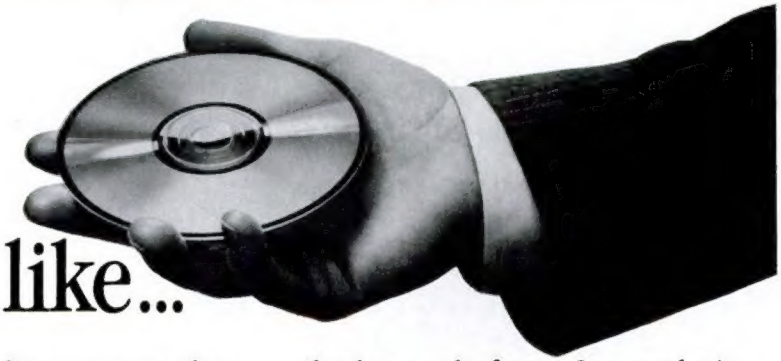
The program's search software is primitive: although it is easy to use, it lacks many important features. It would be nice to be able to jump directly to the location in the text of a search word or words.

At $99, the *Factbook* is reasonably priced and a lot more fun to use than the printed version ($21, 208 pages, available from the U.S. Government Printing Office). As a research tool, the database would be an invaluable and easily accessible source of information for all ages. You can never tell what you'll learn when you start poking around in the CIA's files.

List Price: *The CIA World Factbook* (1988), $99.
Requires: 512K RAM, hard disk, CD-ROM player, MS-DOS CD-ROM extensions. Quanta Press, 2239 Carter Ave., St. Paul, MN 55108; (612) 641-0714.

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by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

Amazing Facts I

"[The Laser Turbo] outfit includes CPU (control pick-up unit; 102-key AT-style keyboard and two disc drives), color monitor and mouse...."
—Spiegel catalogue

Amazing Facts II

"Computers built around this [80286] chip cannot, like those using the newer 80368 [sic], easily run several applications at a time, be linked with other personal computers in large networks, or operate at blinding speed...."
—New York Times News Service article in the *Ann Arbor* (Mich.) *News*, March 8, 1989

Amazing Facts III

"MS/DOS (the [Vendex Headstart] III comes with version 3.3 of the operating system) does not allow copying of files between two different- sized floppy disks, so Vendex thoughtfully provides facilities for doing just that."
—New York Times
March 8, 1989

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ILLUSTRATION: RICHARD TENNANT

Why PS/2 Won't Succeed: Those Printer Upgrades

"[Micro Channel] machines are much faster and can run more-complex software than IBM's previous models. But some business customers were distressed because if they bought the new model they would also have to buy all new accessories and add-ons—printers, modems, etc.—at considerable expense."
—*USA Today*, July 11, 1989

PC Magazine gives you $50 and a *PC Magazine* T-shirt if we use your submission in Abort, Retry, Fail? Warning: Don't write on the original if it might be reprinted; mark up a photocopy or use a Post-it. In case of duplicate entries, the neatest entry wins. Winners this issue: Paul Gold (control pick-up unit), Marc Unangst (two Vendex 80286 items), Neil Halpert (Sidekick).

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THE DELL 386 SYSTEM 325 HAS A 25 MHz CLOCK RATE, CACHE MEMORY CONTROLLER, IDE OR ESDI HARD DISK DRIVE, PAGE MODE INTERLEAVED MEMORY, AND 100% COMPATIBILITY WITH MS-DOS, OS/2 AND UNIX SYSTEM V.

Technically speaking, the Dell System® 325 is one of the most advanced 386™ computers available.

And, according to PC Magazine, it's one of the most advanced 386 computers they've ever tested.

In benchmark after benchmark, the System 325 excelled in a field of 386-based 25 MHz systems. A field that included the Compaq^ 386/25.

A show of prowess that earned the System 325 PC Magazine's Editor's Choice award.

It was a goal we set for ourselves from the very beginning. And an objective anyone with a penchant for power and performance can appreciate.

A PERSONAL COMPUTER THAT'S REALLY PERSONAL.

Of the more than 150,000 personal computers we've sold to date, each and every one has been individually configured to fit the needs of its owner.

The System 325 takes that idea to its logical extreme.

For example, it runs either MS-DOS,® MS®-OS/2, or our own Dell UNIX® System V. Which is compatible with AT&T's System V Interface Definition. And the whole world of XENIX® applications.

If speed is of the essence, we can include an optional Intel® 80387 or WEITEK 3167 math coprocessor.

And since nothing about this system is lightweight, the standard mass storage is a 100 MB hard disk drive. Or we can configure it with a 40, 150 or 322 MB hard drive.

As you might expect, the output is just as intense. You can choose between VGA Monochrome with paper-white screen, VGA Color Plus, or Super VGA for high resolution colors displayed on a larger screen.

Even though the System 325 gives you all this performance, it still leaves you six open slots for whatever else you might want to add.

And once you've told us what you want, we'll make sure what you want works —by burning-in the entire system unit.



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PC MAGAZINE EDITOR'S CHOICE

"The new top-of-the-line Dell System 325 is a flagship worth putting out in front of the fleet."

February 14, 1989

For the full story, see inside back cover.

